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ISSUED QUARTERLY BY THE

DEPARTMENT OF AGRICULTURE, FIJI.

VOL. 4.] FIRST QUARTER, 1931. [No. 1.

EDITORIAL.

IT should be noted that this number is the first issue of Volume 4 of the *Agricultural Journal* and that Volume 3 was completed by the third number published in October, 1930.

Agricultural Convention.—This function was opened by His Excellency the Governor on October 7th, 1930, when a large and representative gathering met in the new Fiji Museum. The subjects considered during the three days devoted to the Convention included dairying, the copra industry, banana production and export, noxious weeds, and minor crops. Contributions to the discussions came from all sections of the agricultural community, and information of value was obtained. The wider basis on which the Convention was organised should enhance its usefulness, and the addresses by those gentlemen who so kindly consented to introduce the different subjects evidenced deep study and a wide appreciation of the agricultural activities of the Colony. The proceedings of the Convention are published in this issue.

Bananas.—The new arrangements for inspection of bananas at the wharf continue to work well, and it is gratifying to record that reports from Auckland state that the quality of the fruit now shipped is excellent. Good prices have been obtained for recent shipments. The handling of cased fruit on the wharf has been greatly facilitated by the use of Morris Conveyors, which should considerably reduce damage by shaking and bruising. The output of bananas has received a further setback by three storms, the first of which occurred on November 23rd, 1930, and affected principally the Wainibuka district, while the others occurred very close together in late February and early March, 1931, and affected much wider areas. At the time of writing it has not been possible to ascertain the actual extent of the damage to bananas and other growing crops, but it is known to be serious and it is feared that fruit exports will be considerably below normal for some months. The banana districts which suffered were the Wainibuka, Wainimala and, to a lesser extent, the Waidina Rivers. The output from the island of Kadavu has increased rapidly and it is expected that the monthly export will soon reach 2,000 cases.

Banana Buyers' Licences, excepting the one issued for the province of Kadavu, expired on the 31st December, 1930. New licences have been issued for all other areas, excepting Ovalau, Moturiki and Gau. A few minor changes have been made, particularly in regard to the Waidina River, which is now shared by the Dominion Fruit Company and the Waidina Banana Syndicate (Messrs. Barber, Abbott and Message). The island of Koro and portion of the Savusavu magisterial district have been proclaimed under the Fruit Export Ordinance and licences will be issued for these areas.

Animal Health.—The discovery of a species of tick (*Hæmaphysalis bispinosa*) hitherto unknown in Fiji has rendered it necessary to restrict the movement of cattle in and from the area bounded by the Lower Rewa

and Tamavua Rivers. The veterinary staff, assisted by a temporary staff, is engaged on the work of inspection and spraying of animals within the area in an endeavour to eradicate the tick. Fortunately, the tick is not a disease carrier, but it causes loss of condition in animals and is therefore objectionable.

FIJI AGRICULTURAL CONVENTION.

October 7th and 8th, 1930.

President.—His Excellency Sir Murchison Fletcher, K.C.M.G.

Chairman.—A. C. Barnes, Esq., Director of Agriculture.

Members of Committee.—Edward Duncan, Esq., Fiji Show Association; J. L. Hunt, Esq., Fiji Planters' Association; Major Clive Joske, M.C., Coconut Planters' Union Limited.

Secretary.—N. G. J. McNally, Esq.

Participating Bodies.—Buca Bay Progress Association; Coconut Planters' Union Limited; Fawn Harbour Progress Association; Fiji Planters' Association; Fiji Show Association; Savusavu West Progress Association; Vanualevu Progress Association.

AGENDA.

Tuesday, October 7th, 2.15 *p.m.*

1. Opening Address by His Excellency the Governor.

Motion No. 1.

2. "The Present Position and Prospects of the Dairying Industry in Fiji"—Address by J. Chapman, Esq.

Discussion opened by A. H. Witherow, Esq.

Motion No. 2.

Wednesday, October 8th, 9.30 *a.m.*

3. "The Copra Industry"—Address by E. Duncan, Esq., and Major Clive Joske, M.C.

Discussion opened by Sir Maynard Hedstrom.

Motion No. 3.—Major Willoughby Tottenham.

2.15 *p.m.*

4. "The Banana Export Industry"—Address by A. C. Barnes, Esq.

Discussion opened by A. H. Witherow, Esq.

5. "The Control of Noxious Weeds in Fiji"—Paper presented by A. C. Barnes, Esq.

Discussion opened by J. L. Hunt, Esq.

Motion No. 4.—E. Duncan, Esq.

6. Closing Address by His Excellency the Governor.

Note.—(1) Meetings will be held in the new Fiji Museum (Carnegie Library Buildings).

(2) Gentlemen who wish to take part in discussions are requested to notify the Secretary prior to the meetings.

(3) If time permits, the production and marketing of minor crops will be discussed.

MOTIONS.

1. That in the opinion of this Convention it is desirable that the Agricultural and allied Associations of the Colony of Fiji should form themselves into a Convention of Associations which should hold an annual meeting to discuss and consider matters of interest to the primary industries of the Colony.

2. That this Convention appreciates the assistance afforded by Government to the dairying industry of the Colony by the increase and extension of the system of subsidies on pedigree and grade stock and welcomes the proposal to pay a subsidy on butter exported from the Colony.

3. That in the opinion of the Convention the position of the copra industry gives cause for disquietude and that the possibilities of securing increased returns to producers should be explored, such as by increase of yield, the reduction of production and transport costs, and the introduction of a system of Government grading.

4. That in the opinion of this Convention a more active campaign directed to the control of noxious weeds in Fiji should be pursued.

His Excellency the Governor in opening the Convention said that he had been present throughout the proceedings of the Conference which was held in January, 1930, and that he regarded these Conferences as of great importance to the welfare and progress of the Colony. It was a trite saying that without agriculture there would not be anyone in Fiji at the present day. There were many ways in which not only agriculture could be improved but also the means of marketing.

His Excellency then briefly referred to the Agenda and said that with regard to Motion 1 it was a most important preliminary step to form some central body so that there should not be isolated bodies coming as they did from time to time to the Government and asking for assistance. He had suggested to the Indian community that they themselves should form a separate Agricultural Association to place their difficulties before the Government.

He said he was intensely interested in the subject of the present position and prospects of the dairying industry in Fiji, and that he had taken the opportunity when in Sydney of making inquiries there. He felt confident that Fiji was at the beginning of a really important new industry. The Government would do all in its power to assist the dairying industry. He drew attention to the motion which dealt with the proposal to pay a subsidy on butter exported from the Colony. He mentioned that this matter was in the Budget coming before Legislative Council. He himself did not consider that the subsidy should be paid for an indefinite period or any too long a period. He drew attention to the Patterson Scheme in operation in Australia whereby every producer paid ½d. per lb on all butter produced. The selling price in Australia was fixed by the producer and the ½d. per lb which they paid to the fund enabled a bounty of 4d. per lb to be paid on all butter exported. He remarked that he had only casually investigated the Scheme but should like to follow it up for possible adoption in Fiji.

Speaking on the copra industry and the motion to be moved by Major Willoughby Tottenham His Excellency said that he did not agree with him as to the cause for disquietude. He concurred that at the moment the bottom seemed to have fallen out of the market but on looking at figures for 20 years ago he found that the same condition of affairs existed then. He felt certain that Fiji was about to turn the corner. With an industry such as this which was one of the most important industries of the world he felt certain that conditions would improve but it was quite true that we had to secure increased returns. He mentioned that this matter had been discussed at length at the January Conference, but he would like to hear further discussion on the question. His Excellency then referred to the motion dealing with a reduction of production costs and transport costs. Transport costs were at the root of everything in this Colony—

transport costs and means of communication. He said that although times were bad he was trying to push on with the road round the island but he was afraid that it was not possible to do much at present.

Speaking on the production of minor crops he remarked that the principal text of the note was connected with Motion No. 1, allied Associations and the question of transport. It was absurd that a Colony with such an excellent soil and climate capable of producing minor crops should find that there was absolutely no market for them. The Government with the assistance of the Director of Agriculture would explore every possibility of establishing some central marketing arrangements whereby the small producer could get a good price for his crops. He entirely agreed with this important motion.

With regard to the banana export industry His Excellency said that this was a matter of the greatest importance and it was unfortunate that there were diseases to contend with. The Government had seconded a Cadet who had a long training in agriculture in England, for the purpose of studying these banana diseases and he sincerely hoped that some advance would be made in their control. There were many questions of the greatest interest connected with the banana industry and one in particular was the system by which the purchase of Fijian bananas was carried on. There was also the question of the Indian growers to be considered. He hoped that the Convention would do something to indicate to Government the proper path to take. Speaking on the subject of control of noxious weeds His Excellency said that on " Koster's Curse " the Thrips were being tried and it was having some success. In connection with this matter there was the question of employing more labour and more mechanical appliances, ploughs, tractors and so on. His Excellency in conclusion expressed his regret that very great pressure of business would prevent him from attending throughout the whole of the sessions.

Mr. Duncan moved Motion No. 1 as follows:—

> That in the opinion of this Convention it is desirable that the Agricultural and allied Associations of the Colony of Fiji should form themselves into a Convention of Associations which should hold an annual meeting to discuss and consider matters of interest to the primary industries of the Colony.

Speaking to this motion Mr. Duncan said that this was the sort of Association that had been aimed at for many years. Dr. Tothill made a very strong effort to form one but unfortunately he was unsuccessful. He considered that the various Associations acting alone were not likely to achieve much success.

Major Willoughby Tottenham in seconding the motion said that he endorsed the necessity for such an Association.

Mr. Barker said that a similar suggestion had been made four or five years ago. The assistance of the Government had been obtained, and the Superintendent of Agriculture, Dr. Tothill had taken a keen interest. Rules had been prepared for a so-called Agricultural Society. Most of the Associations in question at that time favoured the proposal, but one district strongly objected, and on that account Dr. Tothill's efforts did not succeed.

Major Joske said that his Union was mainly concerned with marketing and shipping organisation, but that he was sure all members would heartily support the proposal. Most of the participating bodies with the exception of the Fiji Show Association and the Fiji Planters' Association were coconut planters' organisations and they would welcome the idea. The time might come when the Convention would go from district to district and perhaps

the Government would place at its disposal the " Pioneer " so that meetings could be held in other places in the Colony.

Mr. J. L. Hunt stated that all the Associations, including the Planters' Association would be keen to join the Convention and form one body which would give the views of the Colony. This had been the aim of the Planters' Association for many years. He mentioned that there used to be a Convention of planters consisting of 196 members with branches in not less than five districts, but owing to lack of communication it was difficult to keep in touch with them all. He suggested that the meetings be held from time to time in different districts of the Colony.

Mr. Barnes said that a motion of this description did not mean that the Associations already existing would lose thier individuality. It was hoped that they themselves would continue to exist and extend but if they had some central controlling body they could go to Government backed by the general body of opinion, and this course would carry very much more weight. Under present circumstances Government received complaints, suggestions and recommendations from individual Associations such as those listed, but there was no proper communication between those individual Associations and the Government such as would be provided if a representative Convention were formed.

His Excellency said that he agreed with Mr. Barnes that it was not intended to do away with any of the separate Associations. He instanced Ceylon where they had both the individual Planters' Union and a Great Planters' Union of Ceylon. The district Association represented their views and difficulties to the parent body.

Motion No. 1 adopted.

Mr. J. Chapman addressed the Convention on the dairy industry as follows:—

I have been asked to prepare a paper on the " Present Position and Prospects of Dairying in Fiji." I speak with some diffidence: firstly, because my residence in Fiji has extended only for a period of six years; and secondly, because my experience in the dairying industry has been confined to the Navua district and I have very little knowledge of the condition of affairs in connection with the Rewa and Tailevu districts. Each district must have its own peculiar problems, but there are certain larger questions which must confront all dairy farmers in this Colony, as they have in the past confronted those engaged in the dairying industry in other countries.

Improvement of Herd.—I think probably the most serious problem is the question of improving the breed of cows so as to increase the production of butter fat. Most of the dairy herds in the Colony have been built up on the foundation of local cows. I know that at Navua we bought large numbers of Fiji-bred cows—most of them of no particular breed—many of them allied to beef breeds rather than to milking stock. On the basis of these local herds we are attempting to produce a herd of good milking cattle and with that object in view have imported a number of pedigree bulls, both of Jersey and Friesian breeds. We have now a considerable number of cows of the second generation (*i.e.*, three-quarter pure breed) and the improved results with this young stock are encouraging. We are building up two separate herds—one of them sired by Friesians and the other by Jerseys—and our intention is ultimately to eliminate the Fiji-bred cow of indeterminate descent. This can only be done by a process of selection and elimination and that process is going on steadily all the time, but up to the present the elimination has been done purely on observation and

inspection, we have had no scientific method of herd-testing. After considering this question the Fiji Pastoral Company recently engaged a qualified herd-tester, recommended by the New Zealand Herd Testing Association, and he is at present engaged in tattooing all our cows, according to the New Zealand system, prior to starting a systematic test. It is hoped that by this method we will ascertain with some accuracy the cows which are proving unprofitable. They will be speyed and turned into the beef herd.

The Company's dairy herd consists of over 1,000 females and these are distributed in about equal proportion of Friesian strain, Jersey strain and local stock. We cannot state with any degree of accuracy what is the production of butter fat per cow, but our estimate is about 150 lb per cow per annum. If we can eliminate from the dairy herd, say, 20 per cent. representing the most unprofitable beasts in the herd the average production of those remaining will be substantially increased and we hope that the rejected cows will be replaced by three-quarter bred heifers which again should give a return considerably above the average of the whole herd. If we can increase the average production per head we will at the same time increase the average production of butter fat per acre of land—and that is the biggest problem which faces the dairy farmer in Fiji. With careful selection of sires and the scientific elimination of the unprofitable the average production of the herd must increase. This question is of first importance to every dairy farmer, whether his herd be large or small. The small farmer cannot engage his own herd-tester, but it would seem worth while to consider in each district some form of co-operation whereby the farmer may obtain accurate records of the individual production of each cow he is milking.

Improvements of Pastures.—The next most important problem is the improvement of our pastures so as to increase the carrying capacity and production of butter fat per acre. I am not qualified to speak with any authority regarding the fodder grasses of Fiji as my experience has practically been limited to two fodder plants—Para Grass and Sensitive Grass. Most of the land we are farming at Navua was formerly under sugar and, to some extent at least, before the sugar industry was finally abandoned the land was neglected and impoverished. When dairying operations were commenced an endeavour was made to preserve the para grass which was growing freely on all the flat land but in this effort we have not been successful. We have gone to considerable expense with the sub-division of paddocks and the extent of our fencing will be realised when I tell you that we have forty-seven miles of barbed wire cattle fencing. Notwithstanding this the area under para grass is steadily diminishing and its place has been taken by sensitive. On the low-lying Bila land which is constantly refreshed by flood water para holds its own—even with heavy feeding, but on the abandoned sugar land it succumbs very readily and, as I have said, its place is taken by sensitive. I was very apprehensive when I saw the gradual decrease of para and the increase of sensitive but I have become reconciled to that condition—the sensitive stands very heavy feeding, cattle take to it quite readily, and at present a very large percentage of the butter fat produced at Navua is produced from sensitive grass. I do not suggest that sensitive grass is an ideal cattle food. We have made experiments on a small scale with English grasses and with Paspalum, but the results have not been sufficiently encouraging to justify any heavy expenditure. It would be an excellent thing for the dairy farmers of this Colony if we could discover some grass which would flourish and afford a change of diet and pasture for the milking cows. I cannot help thinking that there must be tropical or semitropical grasses that would be suitable

to our climate and I am looking forward with interest to the experiments contemplated by the Agricultural Department.

Linked up with this question of improvement of pasture is the question of manuring. We have made some small experiments with artificial manures and the results have been encouraging when coupled with a heavy stroke of the disc harrow—areas thus treated showing a marked and sustained improvement. Top dressing without discing does not yield any apparent result. We have not continued these experiments because we have felt that we are working in the dark and that we may easily spend a large amount of money without producing a proportionate return. We have not at our hand the scientific knowledge to decide what elements are missing in our soil and what class of manures should be used to give us the best return in cattle feed. We hope that later we may be able to get technical advice on this subject and I am sure that many dairy farmers will be glad to make small areas of land available for practical experiments with various classes of manures.

The Control of Noxious Weeds.—Our worst pest at Navua is that commonly known as " Koster's Curse." and I understand this is true also of the Rewa district and the Tailevu district. During the past few years we have spent many hundreds of pounds in an endeavour to eradicate this weed. On the main areas we have obtained some measures of control and the expenditure per acre for Curse cutting is very much lower now than it was two or three years ago. We still have a good deal of trouble on areas near our boundary lines because in most cases our neighbours take very little interest in the eradication of this weed and from neighbouring lands the seeds are freely replanted in our fields. I know the Agricultural Department is taking great interest in this question and it would greatly improve the prospects of the industry if we were able to find some natural enemy for this Curse. By the courtesy of the Agricultural Department we have started two colonies of Thrips at Navua but the time which has elapsed has not been sufficient to disclose whether any useful work is being done

Milking Machines.—In Fiji, as in New Zealand, opinions differ as to the advisability of machine milking. My opinion is that in New Zealand the argument is in favour of the machine, but my experience at Navua has led me to form the opinion that as long as Indian milkers are obtainable we get better results from hand-milking than from machine-milking. We had machines installed in three sheds but have dismantled them and packed them away. To obtain superfine cream from machine milkers one must have the most meticulous care and cleanliness and I have not been able to obtain this from Indian assistants. To run milking machines efficiently I consider they must be under close European supervision and as we have eight milking-sheds scattered over a radius of about three miles from the factory, European supervision would be expensive.

Government Assistance.—The Government has already shown its interest in the industry and in one particular district has expended a very substantial amount of money in its development. There are some directions in which we must naturally look for Government assistance and support:—

(*a*) I understand the Government is contemplating a bonus on butter exported and the creation of a Butter Control Board. Provided all interests are represented on the Board I think this will be a very wise move;

(*b*) the Agricultural Department, as I have mentioned earlier, is taking a keen interest in finding some method of economically controlling " Koster's Curse ";

(*c*) the Agricultural Department is considering by-laws to govern milking sheds, factories, &c. So long as these are reasonable and do not at once set too high a standard they are likely to be productive of good, but we must learn to walk before we can run;

(*d*) the Government is interested in the improvement of stock and has made provision to assist importers who desire to introduce pedigree stock;

(*e*) I hope the Government will take a keen interest in the question of the improvement of our pastures, both in the direction of experimenting with new grasses and technical consideration on the subject of manures.

The Future of the Industry.—I think that we must judge the prospects of the future largely by the history of the past. According to records kept by the Agricultural Department the following figures show the production of factory butter in Fiji for the past nine years:—

Year.	*Amount.* (lb)
1921	15,104
1922	23,785
1923	59,219
1924	143,219
1925	168,844
1926	247,724
1927	295,677
1928	307,989
1929	392,214

The percentage increase is not likely to be as great in the future as in the past, but there is every prospect of a steady, solid advancement year by year. In the Rewa district particularly, considerable enterprise has been shown in the introduction of high grade stock and this must have in the very near future a substantial effect on our production. We have substantial areas of land on this island which can be made suitable for cattle grazing and for dairying which otherwise would lie useless and covered with weeds. Such land is obtainable at moderate rentals so that the dairy farmer in Fiji has at least that advantage over the New Zealand dairy farmer. I suggest that the work of the past nine years has demonstrated:—

(*a*) that various breeds of dairy cattle can readily be acclimatised here and remain as healthy and free from disease as in any other part of the world;

(*b*) that the progeny of imported stock (provided thay are suitabably mated) are superior to their sires and dams, probably because they do not need to undergo the process of acclimatisation;

(*c*) that high grade butter, suitable for export to any market, can be produced in this Colony.

Having these three factors fixed I think it only needs energy intelligently applied to insure the steady progress of the industry.

In conclusion, I should like to say that I am more favourably impressed to-day with the chances of success that I was when first I arrived in the Colony.

Mr. A. H. Witherow in opening the discussion said the production of the maximum quantity of butter fat was of prime importance and this could only be done by good feeding and by having pedigree bulls with high

butter fat backing. Herd testing was also very necessary. The dairying industry was suffering from great drawbacks. There were the absence of varieties of good fodder plants for our pastures, the difficulty in obtaining land at reasonable rentals, and the obstacle of noxious weeds. Mr. Witherow then touched on the question of cheese making and said that with a little protection from the Government this could be carried out quite profitably.

Mr. Meek considered that ghee-making should be investigated. Another point he would like to mention was the enormous loss to the dairy farmers through carrying in their herds diseased animals.

Mr. McElwaine said that he had been interested in dairying since its inception in the Colony and he considered that pasture was the most important thing that was holding back the progress of dairying within the Colony. He said that another important point was the subsidy paid by the Government on pure bred bulls and cows which was £10 per head. This sum practically covered the whole of the expense of bringing the animal from New Zealand with the result that dairymen in Fiji are on the same footing as dairymen in New Zealand More rapid transport of cream from farm to factory was necessary.

Mr. Turbet said he shared with the previous speakers the optimism for the future of the dairying industry. He remarked that he would support at least the temporary appointment of an official herd-tester. With regard to pure bred bulls, Geneticists and animal breeders had found that a bull transmits his ability for milk producing to the female line rather than to the male line and that a bull should not therefore be judged on his pedigree but by the results of his heifers. Mr. Turbet went on to say that for many years experiments in connection with pasture grasses from temperate zones had been carried out by the Agricultural Department and private individuals and sufficient information had been gathered to say that these countries had no grasses suitable for our conditions. It was necessary to turn to tropical and sub-tropical climates such as Hawaii, and the Philippines. He mentioned that there were two serious diseases in the dairy herds, tuberculosis and contagious abortion. A move had been made to eradicate tuberculosis from the registered dairies in the Suva district. Rules were being drawn up for compulsory testing for tuberculosis. This was only a beginning but before long he hoped to see it extended to the three areas supplying milk to the factories. Contagious abortion was chiefly apparent at Navua, but it was also on some of the Tailevu farms and on at least one Rewa farm. Steps were being taken to control the disease restricting the movement of cattle from the affected farms. He said that the efforts had been fairly successful and he hoped that eventually the disease would be eliminated.

Mr. Fernandez discussed the freight on exported butter. The Union Company charged 3s. 9d. per box from Suva to Auckland and the freight from Auckland to England was 3s. 6d. With regard to the production of butter at the Rewa Factory he said that in 1925, 58,000 lb of butter were manufactured at a cost of 4¼d. per lb, for the year ended 1927, 104,000 lb at a cost of approximately 3¼d. and for the year ending June, 1930, 133,000 lb at a cost of 2½d. Thus the larger the production the lower is the cost of manufacture. He considers that unless the Government made herd-testing compulsory it would never be carried out in Fiji.

Mr. Stuchbery said that he considered the use of concentrated foods as a matter of importance in Fiji because our only fodder plants were very bulky foods and the cattle did not always get the amount of nutriment that they could assimilate in the production of their butter fat. He men-

tioned that although they had experienced a dry season on the Western side of Vitilevu the Colonial Sugar Refining Company had maintained their production of butter fat by the use of cotton seed. The Colonial Sugar Refining Company were carrying out experiments with top dressing and he was much impressed with their efforts.

Convention adjourned until 9.30 a.m. on Wednesday, 8th October.

Thursday, 9th October.

Mr. Barnes in reopening the Convention said that he would summarise some of the more important points that had been brought forward. The first of these was the manufacture of ghee and he intimated that work was proceeding by the Agricultural Department to ascertain whether it would be possible to manufacture this product locally. With regard to the use of concentrated foods he said that it was well recognised that fodder grasses could well be supplemented by the use of concentrated foods such as coconut meal, ground nut meal, rice bran and cotton seed. Experiments in connection with fodder grasses took a long time to achieve results which could be recommended for general practice. He drew attention to an Article in *Agricultural Journal* No. 2 of 1930 dealing with the use of manures for keeping pastures in a constant state of fertility. He remarked that the Government were fully alive to the desirability of placing the dairying industry upon a sound footing and with this object had increased the subsidies payable on imported pedigree stock, grade cows and heifers. It was also proposed to introduce a subsidy on export butter.

Mr. Speight moved Motion No. 2 reading as follows:—

> That this Convention appreciates the assistance afforded by Government to the dairying industry of the Colony by the increase and extension of the system of subsidies on pedigree and grade stock and welcomes the proposal to pay a subsidy on butter exported from the Colony.

The above motion was seconded by Mr. A. H. Witherow.

Mr. Duncan said that he was unable to support the final clause of Motion No. 2 regarding the subsidy on exported butter. The dairying industry had been going for 10 years and in addition to the direct subsidy had had 4d. per lb in its favour since it started. He proposed that the last clause be eliminated.

Major Willoughby Tottenham in seconding the amendment said that the butter industry was likely to become " an old man of the sea " and the industry would never grow up and stand on its own merits if it was pampered too much.

Mr. McElwaine said that the high cost of manufacture was due to the small output. The present cost of manufacturing 1 lb of butter and placing it on the market was 7·25d. per lb while the average cost in New Zealand was 2·5d. per lb for a factory manufacturing somewhere in the neighbourhood of 200 tons. The industry in New Zealand and Australia had been established for 70 or 80 years.

Mr. Barnes said that New Zealand had been cited on several occasions and it was interesting to note that in 1880 the value of export of butter from New Zealand was £8,350 and that time one might say that New Zealand was in a similar position to Fiji to-day. In the 10 years following the annual export increased to £122,700. The value of butter exported from New Zealand increased rapidily and in 1928 reached £11,960,000. He mentioned points to indicate that an industry of this nature invariably

had a small beginning and that the object of the original proposal was to arrange for the payment of some form of subsidy to assist the industry to get on its feet. He suggested that the final phrase of Motion No. 2 be amended by the insertion of the word " welcomes."

Sir Maynard Hedstrom said that he did not think it would be possible to find a common ground and that the Motion should be forwarded as an expression of opinion of the dairymen of the Colony.

Mr. Barnes said he proposed to do this and Motion No. 2 was therefore withdrawn.

Major Joske read *Mr. E. Duncan's* address on the copra industry as follows:—

I have been asked by the Director of Agriculture to give you an address on the copra industry of Fiji. I fear that the subject is too big for me to do full justice to in the time at my disposal, and I shall therefore merely confine myself to an outline sketch of the industry.

The Fiji Blue Book for 1929 gives the area of nuts in the Colony as 113,564 acres and the export of copra as 28,391 tons. I am under the impression however that the export of copra last year exceeded 33,000 tons, and believe that the area of coconuts in the Colony to-day has reached 150,000 acres. Relative to the area in the Colony which has been reclaimed from jungle, that of coconuts exceeds by far the area of all other cultivated crops combined; and I believe its importance to the Colony generally but especially to the native Fijian, is in direct proportion to its area, though its monetary value does not to my mind place it second in the list of crops, as shown by the mere statistics of the Blue Book. Sugar for instance is grown and concentrated compulsorily in only five districts in the Colony and at most covers 75,000 acres. (Blue Book figures give the area of sugar as 37,000 acres but this is wrong, apparently the areas of sugar land under young plant cane for the following year and in green manure crops having been omitted). Coconuts on the other hand cover 150,000 acres and the location of this growth extends to every inhabited island if the Fiji Group, hence my contention that the copra industry is by far the most important of any in the Colony.

Unfortunately, from various causes and reasons, copra production at the moment is not a paying proposition. Sugar, despite a protective tariff or bounty, at the expense of the consumers in Britain and Canada and to the extent of 50 per cent. of to-day's open market values, as also rubber, are both however in the same unenviable category if that is any consolation. Since restriction of production is out of the question and since we must continue to produce or go under, we must reduce the cost of production if we are to keep our heads above water in the flood of competition which surrounds us. Taxation in steadily increasing ratio to the value of our products cannot be imposed, as it has been for the past 20 years in Fiji, without increasing the costs of living in the first instance, and in the next instance, forcing an accompanying higher all round wages cost of production, and this precisely is what has happened in Fiji in the copra industry, as I shall show later in this paper. Not so long ago the annual budget of Fiji was £450,000 per annum and the population was 150,000, whilst to-day the figures are £650,000 and 165,000 of a population, showing an increase of approximately 50 per cent. in taxation and 10 per cent. in population.

It is in my opinion from these happenings that we are chiefly suffering to-day in our inability to produce profitably in competition in the open markets of the world. We have got " out of step " with costs in most

British Crown Colonies, but especially with those of the Dutch and Philippine Islands producers and are consequently being "trod upon." The actual coloured labour wages cost of producing a ton of copra in Fiji to-day is in the vicinity of £5, as against £2 10s. of 10 or 12 years ago, while to land a ton of copra in Suva, including wages as above, sacks, freights and insurances, European supervision and essential plantation supplies costs approximately £11, as against £7 as recently as about 10 years since. It would be futile besides being undesirable in my opinion had I failed to allude to or attempted to disguise these facts.

Improved methods of production, especially in curing our product by means of economic kiln drying and processing, hold some, though I fear at the moment rather remote, promise of better profits; but unfortunately most improvements cost money and money is a very scarce commodity with copra producers in Fiji to-day. Copra grading and the production of high class copra also come within the category of improvements that can be made in the copra industry of to-day, fortunately at small cost. When starting grading, which must be done under Government auspices and be made compulsory and applicable to all copra shipped from the Colony, difficulties and opposition may be experienced, yet I believe that its value would soon be demonstrated and ultimately grading would be welcomed by all classes of producers of and traders in copra in Fiji.

I do not purpose to go into details on the wages, tasks and such like of our labourers, but may say here that all planters fervently hope that in the revision of the Fiji Labour Laws, which it is generally understood the Government are contemplating, neither the obligations of the planters will be made more onerous or costly nor the liabilities of the employees lessened in any way, than in the existing Ordinances, and that contract or task work will be permitted and governed as at present with clear understanding that "no work, no pay" shall be the rule. Planters feel too that, if they provide food, housing and hospital amenities, they should no longer be called upon to furnish tobacco and clothing or prepay any Government taxes which may be imposed on workers engaged by them.

In conclusion some data may be given which may interest coconut growers: for ordinary trees the spacing should be not less than 30 feet by 30 feet in wet or 28 feet by 28 feet in dry districts. The yield over an estate of several hundred acres fronting the sea and running inland, say, one mile varies between 6 and 7 cwt. dry copra per acre per annum. On any such estate 5,800 to 6,300 nuts make one ton of copra. Usually 52 per cent. dry is obtained from green copra. The cost of producing and landing in Suva of one ton of copra, always provided the coconut areas are kept weeded and decently clean, is not less than £10 per ton, exclusive of interest on capital invested. Coconuts on Taveuni bear well up to 80 years of age, though their maximum yield is probably obtained when they are 20 to 50 years old.

Finally, as to the actual value or cost of the 150,000 acres of coconuts in the Colony to-day, this cannot be set down at less than three millions sterling. That of sugar on the other hand, stands at about one and three-quarter millions sterling, to which it has been written down from possibly three millions sterling several years ago. Then too there are many hundreds of thousands of acres of potential coconut lands scattered throughout the Colony still unplanted, whereas no sufficiently large areas yet remain in the dry districts to which successful sugar production is confined, for the establishment of more than one or two sugar mills. I estimate that at least there are half a million acres of unplanted coconut lands in the Colony, all of which could be brought into cultivation by the natives, or by European planters

if the wages and other costs of production were on a parity with those of our chief competitors.

Major Joske said that they had listened with great interest to the paper presented by Mr. Duncan, since he was not only the owner of one of the half-dozen biggest estates but also one of the Managing Trustees of the group of estates with the largest production in Fiji. Mr. Duncan's reference to the necessity of reducing costs of production justified the speaker in putting before the Convention three suggestions in this direction which would, he hoped, serve as targets for criticism from those present

Major Joske said:—In his address Mr. Duncan has brought his copra from its plantations to its port of export from the Colony. As we are now in Suva, let us imagine it arrived alongside Suva wharf. It is now on its journey to the crusher, and it is the costs incurred on that journey which are of vital interest to the producer in Fiji. I suggest therefore we might examine those costs for a minute. They are—

1. the labour costs involved in taking the copra from the side of the interinsular vessel, weighing it, putting it on a lorry and running it a few yards to a copra store, and finally stacking and storing it;
2. the cost of storing it, *i.e.*, interest paid to the bankers whilst the copra remains idle in Suva, and insurance against the risk of loss by fire, and the shrinkage and depreciation of the copra itself;
3. the labour costs involved in stacking and weighing the copra, carting it across the road and delivering it to the ship's side.

I suggest that it is in (1) and (3) that copra passing through the port of Suva meets with costs that could be eliminated. Mr. Duncan said that we have got out of step with costs in most British Colonies. Plantation labour costs are higher. Therefore, we must make every effort to reduce all other costs to the bare minimum. There is a way in which the Fiji Government can be of practical benefit to the coconut planters and also benefit the other sections of the community. That is by improving the wharf facilities at Suva. Suggestions have been put forward from the Suva Chamber of Commerce; the matter was raised a year ago in the Legislative Council; but so far we have not heard of any progress having been made.

My own view is that the following improvements to the facilities for dealing with copra at Suva should be made as soon as possible—

(*a*) the strengthening of the wharf structure, so that motor lorries can load and discharge copra underneath the steamers' slings;
(*b*) the provision of a waiting shed for copra;
(*c*) a Government weigh-bridge.

As to (*a*), at present lorries are not permitted on the wooden structure of the wharf, which is too weak to bear them. This is indeed a lamentable state of affairs at the prime port of the Colony, and I venture to say there are very few ports in the world which would confess that their main wharf was too weak to stand an ordinary motor lorry. To take an example, at present copra ex " Makatea " in Suva is man-handled four times inwards and five times outwards. If motor lorries could come alongside steamers, it would be practicable to instal a weigh-bridge and the nine man-handling operations of copra could be cut down to four.

As far as (*b*) is concerned, as is well known there are frequent occasions upon which it is impossible for exporters to obtain export storage, on account of inward merchandise. The need for extra storage has already been recognised, but I would urge the extension of the present so-called storage facilities.

There is a space lying idle on that part of the wharf between No. 3 shed and the Harbourmaster's office, and I would very much like to see a shelter shed erected thereon in which storage for up to one week would be afforded to exporters. After all, copra pays an export wharfage of 6d. per ton. The cost of this shed need not be very great, practically a roof set on concrete pillars with weather protection at the side.

As to (*c*), I have suggested a Government weigh-bridge because weights taken under Government supervision would be probably more acceptable to the producer, the exporter and the prospective purchaser overseas. I suggest it really from policy reasons, but I would add that under present conditions, private enterprise would be prepared to instal a weighbridge if Government decided such a thing was to be left for private enterprise. In such a case of course one would not expect Government to reverse its decision and subsequently instal a weigh-bridge in competition. I have sketched the above in outline as this is not the place in which to go into the matter in detail. I put it forward as a practicable suggestion for reducing the costs of the operation of moving the copra from the planter to the crusher.

My second suggestion is to do with the overhead costs of the coconut industry. One of the most important of these costs is that of borrowing the moneys necessary for development. The planters' capital is restricted and the occasional advent of a hurricane depletes the larder. Now that the Colony has a better supply of labour one of the obstacles to the development of coconut areas has been removed. I suggest that the Government should help on this development, and thereby follow the example of many other countries— by making available loans to coconut planters at low rates of interest, repayable over a long term of years. At present the coconut planter would have to pay 7½ per cent. interest to his banker plus probably ½ to 1 per cent. to his guarantor if he desired advances. I suggest that Government might make advances to approved settlers at bare cost, say, 5 per cent. plus the necessary provision for sinking fund, and amortization. The business could quite easily be handled by a Coconut Advances Board of Control on very much the same lines as for example, the Returned Soldiers and Sailors Advances Board. Personally, if I were choosing a Board to-day I should say that a Board composed of the Colonial Secretary as Chairman, the Colonial Treasurer, the Director of Agriculture, Sir Maynard Hedstrom and Mr. Duncan would be hard to better. It may be argued that this time of depression in the price of copra is the wrong time to consider such a proposal; quite the reverse, as it is in times such as these that the planter needs financial assistance in the greatest possible degree.

My suggestion is intended to apply not only to development but to existing mortgages. The price of copra was not always going to remain where it was to-day. I hope although I would not bet on it—to see it back to worth round about £15 a ton at the plantation in perhaps twelve to eighteen months.

I now come to the third suggestion which is one for improving the price obtained for the planter's copra. We had the pleasure of seeing yesterday* a very interesting exhibit put up by the Coconut Committee, and the difference between ordinary native sundried copra and copra which had received some reasonable attention was most marked. I think there can be no doubt that good quality is worth more than inferior, or even medium, and this is probably more especially the case under present circumstances where more and more of our copra is finding its way to the United States. That being the case, we should encourage the United States to look to Fiji

* At the Fiji Show.

for their supplies of good quality copra. There can be no doubt that we have got the goods, but on the other hand, we are not making the most of them. My third suggestion therefore is the separation of good copra from bad copra, and the issue of Government certificates on which the buyer can place the utmost reliance. At present the crusher buys 100 tons f.m.s. copra from Fiji. He may have the luck to have included in the consignment some of the nice white copra we saw on Monday. On the other hand, he may get a dirty weevily article. Being a prudent man, he therefore insures against this possibility in the price, which he pays for his parcel of copra. In other words the good copra is damned for its association with the bad. One might also quote Gresham's Law—that a bad coinage drives out the good.

This matter has been before the Legislative Council as far back as 1927, and a scheme was drawn up which provided for compulsory grading of copra intended to be exported. When the Bill came before the Council it was varied by the substitution of voluntary grading for compulsory grading, and became a dead letter. The view of the Directors of the Coconut Planters' Union is that to succeed at all, grading must be applied to all copra leaving Fiji. We feel too that if Fiji leads the way in establishing certain standards, it may be possible before long to obtain the co-operation of Tonga and Samoa in establishing similar standards. The buyer of copra in San Francisco or in London will then know what he is getting, and it will serve to eliminate the present gamble against securing a good, bad or indifferent delivery against his purchase of South Sea copra.

Everyone will be unanimous on the question of the difference in the quality of plantation copra and ordinary native dried copra, the logical thing would therefore seem to separate these grades. The objections are:— Firstly, the cost of such grading and, secondly, that no increase in price will thereby be received As I am representing the Union established at Suva, it is only proper that I should view the question of costs at Suva alone. Earlier in this paper, I made suggestions for cheapening the handling of copra at Suva, and one of these suggestions involved the erection of a waiting shed for copra. I would propose that this shed should be utilised for the reception of copra at Suva, and that the grading should take place in that shed, or in licensed warehouses owned by responsible exporters, by some suitable officer of the Agricultural Department. An appropriate export mark should be allotted and the copra marked accordingly. The additional cost will therefore be very small, probably only a matter of a few pence per ton, and I submit that the increased revenue to those who sink money, time and care in improving their product will more than justify the results.

As to the second objection that the results will not be commensurate, I imagine this has been an objection to grading of produce ever since the word was first known. Its truth or otherwise in the case of copra can only be proved by experiment over a period of years and since the method I have outlined is one involving no capital outlay, which will not be of great advantage in other ways, I suggest that the objection should not prevent the adoption, at any rate experimentally, of compulsory grading for export.

In summing up the three suggestions I have put before you perhaps I may call them Faith, Hope and Charity. May I say that Faith stands for copra grading and the consequent faith of the crusher of copra in the quality of Fiji copra; Hope for the hope that the Government will improve handling facilities at Suva; and Charity, which begins at home, for the extension of cheap loans to poor planters in these hard times.

Sir Maynard Hedstrom in opening the discussion on this paper said he had been asked many times his opinion as to the reason for the long and continued slump in price of copra. From what Mr. Duncan had said one might gain the impression that the price of copra was influenced largely by the quantity produced but he did not think that that was a factor because the increase in the production of copra had been comparatively small. In 1919 the world's crop was estimated at 785,000 tons and in 1927, 1,135,000 tons. He considered that the factor controlling the price of copra was the production of thousands of tons of Soya bean and ground nuts. In 1920, the production of Soya bean was 719,000 tons and in 1927, 1,958,000 tons. Another factor of importance during the last few years was the production of whale oil. Eight years ago this was 450,000 barrels and in 1928 the production increased to 1,500,000 barrels, while the production for 1929 was estimated at 2,000,000 barrels. The copra producer had his whole investment in his plantation and could not stop making copra just because the price was low, while the growers of linseed, Soya bean or ground nuts could turn their hand to something else if the price was not profitable. Sir Maynard went on to say that with regard to the grading of copra he did not think that any good could be achieved by compulsory Government grading.

Mr. Taylor outlined the position with regard to the control of coconut pests, namely Levuana, Scale and Spathe borer. He said that the work on the first two pests had been brought to a successful issue and the borer work was promising.

Mr. Surridge suggested that instead of the square system of planting the equilateral triangular system should be adopted since this adds about 10 per cent. more trees to the acre without any disadvantage. With regard to the question of grading it had been found essential to adopt compulsory grading methods with most agricultural produce, for example, coffee, maize, cocoa, butter and fruit. It was reasonable to assume therefore that methods which have improved the quality and price of such produce should tend to have the same result when applied to copra. Mr. Surridge referred to the rat as a pest of coconuts. He stated that the average damage by this pest to coconut plantations was probably 5 per cent. for the whole of the Colony while on individual plantations it had been estimated after investigation at about 12½ per cent. This was a matter that required urgent attention.

Mr. Barnes said that the address and discussion could not but be interesting to any person whether he was directly concerned in the production of copra or not. One of the most important points raised was the general activity directed to the reduction of rats. He said that extermination was perhaps something too much to be hoped for but there was need for active measures on the part of all people in the Colony to suppress these rodents which caused damage amounting to hundreds of thousands of pounds per annum. He said that he was strongly in favour of improving the wharf facilities at Suva which would have for their object a reduction in the costs between the producer and the crusher. With regard to grading of copra Mr. Barnes said that perhaps instead of a system of grading, the producer might be encouraged to turn out a higher quality of product and to endeavour to get more from the same amount of raw material. In an article in the *Agricultural Journal* by the Government Chemist it was shown that 12 per cent. of the copra is lost through insects and mould. This represented almost one eighth of the copra exported and meant a loss of £1 per ton on the present day price at the plantation.

Major Willoughby Tottenham moved Motion No. 3 as follows:—

> That in the opinion of this Convention the position of the copra industry gives cause for disquietude and that the possibilities of

securing increased returns to producers should be explored such as by increase of yield, the reduction of production and transport costs and the introduction of a system of Government grading.

Major Willoughby Tottenham in speaking to this motion said that the noxious weed problem was serious. The keeping of these weeds down added considerably to the cost of producing copra. He said that Major Joske had urged the provision of more shed accommodation at Suva but he considered that wharf and shed accommodation should be provided at other places in the Colony, for instance at Buca Bay or Taveuni where the copra was produced. If this were done costs would be reduced about 12s. per ton.

Major Joske seconded Motion No. 3 which was carried.

THE BANANA EXPORT INDUSTRY.

After the luncheon adjournment Mr. Barnes reopened the Convention and addressed the meeting on the banana export industry, which he said was of considerable importance to Fiji, but had unfortunately deteriorated during the past few years mainly owing to the incidence of disease and the irregular and improper methods or lack of methods practised by the Fijian cultivators. The industry had been adversely affected by the hurricane of December, 1929. He remarked that minor amendments had been made to the Regulations and the most important of these was the appointment by the Governor of a Banana Licensing Board which would have power to fix the minimum price to be paid for bananas at packing stations. Indians were very anxious to obtain the same treatment as Fijians with regard to the purchase of bananas and this question was being considered by Government. Mr. Barnes went on to say that considerable uneasiness had been caused amongst banana buyers at the more strict interpretation of the Regulations governing the export of fruit from Suva. He said that reports had been received from merchants and Inspectors in Auckland indicating that there was considerable laxity through the whole industry at this end and that the growers were cutting fruit which was unsuitable for export. It was felt in the interests of the whole industry that that state of affairs should not be permitted to continue and instructions had been issued to the inspecting staff that a much stricter inspection of the fruit was to be made. He remarked that much still remained to be done in connection with the improvement of the general quality of the fruit offered at the packing stations and he felt that all those concerned in this important industry had a long way to go in the work of instructing the native and the Indian grower in the grades and quality of fruit suitable for export. The Department of Agriculture in conjunction with the Native Affairs Department were doing everything they possibly could to teach the Fijian grower. With regard to the packing Mr. Barnes said that he could not help but be struck by the general inferior quality of the cases which were used for Fijian bananas. He considered this one of the weak points of the banana industry to-day. He gave an instance of cases from Sweden and Norway being imported to South Africa at about 1s. ½d. Another important matter affecting the banana industry was the question of transport. He had it on good authority that a large number of cases of bananas could be secured from the Savusavu district if only regular transport arrangements could be made to pick them up. Similarly he felt that there was every prospect of reviving the industry in the Sigatoka district if some regular system of transport could be evolved. He remarked that the banana industry in

normal years was worth £200,000 per annum to the Colony of Fiji and at the present time we had only one quarter of that. Mr. Barnes went on to say that recently trepidation had been felt because of the threatened competition from Samoa and Tonga. If Western Samoa could be sure of a regular steamship service with proper provision for fruit, Fiji could be almost entirely cut out of the New Zealand market. He thought that New Zealand preferred Fijian bananas but there was always the possibility that some arrangment might be made to extend the industry in Samoa and get those bananas from Samoa to New Zealand. He said it must be borne in mind that Samoa was a Dependency of New Zealand and though we had a better quality of fruit there was the danger of losing the whole market if we did not improve and keep on improving our standards.

Mr. Witherow said that the position of the banana export industry was very poor compared with what it was when the Australian market was open to Fiji. The high rate of freight was a hindrance to the industry. In 1916 the Union Company notified the shippers that it would be necessary to raise the freight from 1s. 9d. to 2s. per case. From then onwards there had been a gradual rise until now the freight is 4s. per case—more than double what it was in 1916. Mr. Witherow intimated that he still considered there were prospects of profitably shipping to Australia.

Mr. N. MacDonald said that a subject of this nature could be classified under three headings, shippers, buyers and native growers. He remarked that he did not think some buyers took sufficient interest in the areas allotted to them. He considered that every endeavour should be made to establish demonstration plots in each district where methods of cultivation, selection of plants, and proper planting could be shown. The natives should be instructed in the use of implements.

Mr. Windham said that he had been investigating diseases which were causing havoc to the industry. He said the plantations in Fiji were very scattered and this made the work very difficult.

Mr. J. L. Hunt said that the present rate of export was about 7,000 cases a month. One person with 1,000 acres of land would be able to export 15,000 cases per month and it would not be as expensive as now. He said he was very pleased to see that the Government had taken in hand the investigation of the diseases of bananas. Little work of this description had been done of recent years.

CONTROL OF NOXIOUS WEEDS IN FIJI.

Mr. Barnes presented a paper on "The Control of Noxious Weeds in Fiji" (*vide Agricultural Journal No.* 3 of 1930).

Mr. J. L. Hunt in opening the discussion on The Control of Noxious Weeds in Fiji said that in 1889 there were practically no noxious weeds in Fiji. Now the people of the Colony were right up against things with animal life carrying the seeds of noxious weeds and so increasing their spread. The expense of clearing was very heavy, ranging from £3 to £5 10s. per acre. He was pleased that the Entomologists of the Agricultural Department had been able to introduce the Thrips to assist in the control of Koster's Curse and he considered that the people of the Colony would have to look to the Entomologists of the Agricultural Department to help them in the eradication of other noxious weeds.

Mr. T. H. C. Taylor said that the control of noxious weeds by means of insects was one of extreme difficulty and that people expected rather too much in that direction. Although work had been going on for many years on the subject of the prickly pear in Australia it was only lately that

any marked progress had been shown. He said that he wanted to emphasise that the greatest care must be taken in introducing insects to control weeds. For instance there were at least twenty different species known to exercise a control on "Koster's Curse" but a lot of investigation was necessary to decide whether or not some of these insects would attack crops of economic importance in the Colony. He thought that it was likely that the biological control of "Koster's Curse" would be a long work and that other insects would have to be imported. He informed the Convention that in the case of Lantana considerable success had been achieved in certain districts, but he must again state that the biological control of noxious weeds was only in the experimental stage and people must not expect rapid results.

Mr. Barnes said that efforts had been made to introduce a parasite for Guava and although inquiries had been made in various parts of the world no success had been attained. He said that experiments were being carried out by the Department of Agriculture in the use of various types of sprays including sodium chlorate.

Mr. E. Duncan in moving Motion No. 4 as follows:—

That in the opinion of this Convention a more active campaign directed to the control of noxious weeds in Fiji should be pursued.

said that he hoped eventually we should be successful in controlling "Koster's Curse." He instanced that on Taveuni every ton of copra produced cost 30s. for weeding.

Mr. A. H. Witherow seconded the motion, which was carried.

Mr. Barnes said that there was one other subject for discussion, the production and marketing of minor crops and this would be considered at a later date.

Mr. Barnes in declaring the Conference closed said that His Excellency had informed him that the Convention could be assured of His Excellency's full sympathy and he hoped the deliberations of the Convention would benefit the Colony. Mr. Barnes said he would like to make a few remarks in connection with the Convention of Associations which was the subject of Motion No. 1. That expression of opinion was backed up by the representatives of the various Agricultural and allied Associations of the Colony and was one that would ultimately be given effect to. It would be necessary to draw up and consider rules and regulations for such a Convention. He considered that each Association should be permitted to nominate a certain number of members to serve on the Convention, the number to be decided by a Committee which would sit to consider this matter. He said the Convention would also encourage and assist the formation of District Agricultural Associations and would permit representation on the main body on terms to be decided upon. He saw no objection to the utilisation of the *Agricultural Journal* as the medium of publication for Convention matters. He suggested that the Committee already appointed should be authorised by the meeting to continue its work and to co-operate with representatives from other associations in Fiji to devise Regulations and to form a Convention of Associations. Speaking on the the other subjects raised during the discussion Mr. Barnes said that quite a lot of important matter had been dealt with. With regard to the Dairying Industry it was a matter of great pleasure to him to hear a discussion on a wider basis than on the occasion of the January Conference. Referring to the Copra Industry he said that the Convention had been able to follow the coconut from the tree to the market and to find out where best it could be helped. He said the Banana Export Industry had come in for its fair share of consideration and certain proposals put before the Convention would receive attention.

The subject of control of noxious weeds was one that was of very wide interest. During his experience in Fiji and from remarks of those he had met, Mr. Barnes said he could well believe what a menace the problem is to agricultural industries and it was the duty of the community to see that the menace was attacked in no uncertain manner. He said the thanks of the Convention were due to the Committee which sat to organise the first meeting. Thanks were also due to the Trustees of the Fiji Museum for placing the room at the disposal of the Convention for the purpose of holding the meeting. In conclusion Mr. Barnes thanked all who had attended and had contributed by reading papers and taking part in the discussions.

Mr. J. L. Hunt proposed a vote of thanks to the Chairman which was carried by acclamation.

Mr. Barnes then declared the Convention closed.

Saturday, 12th October, 1930.

Mr. Barnes in opening the discussion on the Production and Marketing of Minor Crops said that the definition of minor crops was a fairly wide one and for the purpose of the discussion could be taken to include all crops apart from sugar, coconuts and bananas, and of course, dairy products. He remarked that there were undoubtedly a large number of crops grown in small areas in different districts either in conjunction with major crops or else as separate little agricultural industries. Some of these found their way by devious channels to the local markets in Suva and other parts of the Colony, but there was no organised system either of production or marketing. He said that he had received inquiries from Sydney in particular and from other places for some of these minor crops which could be grown satistactorily here in sufficient quantity and of sufficiently high quality to command good prices in overseas markets. He remarked that he had been informed by one distributing firm in Sydney that there was an excellent opportunity during June–August to place French Beans on the Sydney market and it was reasonable to expect that one could obtain a price for a properly graded product equivalent to 12s. to 20s. per bushel case. There was also a good demand for the seed in Queensland and New South Wales and he was led to believe that the value of the seed was from 45s. to 60s. per bushel. Mr. Barnes then instanced the water melon which grew well in Fiji and for which a ready market existed in Sydney. Small farmers should be encouraged to grow these minor crops provided that some satisfactory organisation existed for marketing them. He went on to say that that point was one of the most important in the agricultural development of the Colony and with that object in view His Excellency had appointed a Committee to consider the agricultural methods of Fijians and Indians. Mr. Barnes read a letter received from Messrs. A. Q. McGowan regarding minor crops and said that this indicated that ready markets existed for a wide range of products which grew well and produced heavily in Fiji but that apparently growers were not prepared to accept world market prices for their produce. He said that this opened up the question of the need for a sound agricultural educational programme directed not only to the education of the children in the school but to the producers on the land.

LETTER FROM A. Q. MCGOWAN AND CO.

Dear Sir, Suva, 10th October, 1930.

We have pleasure in handing you the following information relative to experiments and possibilities of business conducted by us covering products which we consider would be profitable to small farmers here.

Kumalas, (Canadian Market).—A trial shipment of mixed red and white kumalas to Vancouver were disposed of to Canadian Pacific Mail Steamers realising 18s. per cwt. They were not landed or sold to merchants there for the reason that only white kumalas were in demand. We have not been able to interest any local growers in the export of white kumalas to Canada. A large market is open to us for these during the winter months only—December to April.

Maize.—Trial shipment to Vancouver of good quality clean, new maize received favourable comment, and resulted in many inquiries and orders for parcels of 50 tons and up to 200 tons per month. However, the local price was not in keeping with the world's ruling market, which at that time was £9 per ton c.i.g. or about 4s. 6d. per bushel c.i.f. We endeavoured to get maize production going on a large scale, but no grower was interested. We have not since been able to induce any Indian or European to grow maize for export.

Peanuts.—Growers in Fiji will not accept the world's market for export and refuse to produce except for local requirements, and at a price to suit their own ideas. We have tried out the possibilities in shelled Fiji peanuts on the New Zealand market, however, we had to meet the Java competition which would not allow us to do business at present values. Fiji shelled small peanuts are worth about £20 per ton c.i.f. Auckland. Java large shelled nuts are worth to-day £25 per ton c.i.f. No large peanuts are at present produced here, the growers stating that they present a little difficulty in harvesting as against the easier grown small nuts. Fiji shelled peanuts are declared to be far sweeter and firmer than the Java varieties sold. Price is the factor. We cannot compete.

Blackeye Beans.—These can be produced here cheaply and at competitive prices for export. The difficulty is, however, to supply a clean sample free from weevil. We have not yet secured a clean, dry sample grown by Indians, and have therefore given up the experiment.

Cow Peas.—Each year we receive numerous inquiries for quantities, however, the same remarks apply as to Blackeye Beans.

Rice Beans.—We also receive inquiries for large quantities, but the same remarks apply.

Ginger.—We have successfully established an export market for green ginger during the months of January to June only, and will be exporting during the coming season. Growers receive £18 per ton delivered to our store for prime, clean, well-grown samples only. No inferior quality is exported on any account. We have a big outlet for cargo ginger packed in light syrup in barrels. But this business cannot be tackled until the production reaches some volume. This is worth to-day £60 per ton c.i.f. We are hoping to establish business in cargo ginger within the next 18 months, provided the growers will increase their production sufficiently.

Pepper.—We have received inquiries for this but there is no production in Fiji. All our requirements are imported from Singapore, and costing to-day £168 per ton. This is also largely consumed by the Indian population.

Coriander Seed.—This does well in Fiji, but growers demand a higher price than the landed cost of imported seed. So that no export business is possible at present. This is worth to-day £15 per ton c.i.f. London for prime quality, market fluctuates violently depending on crops in India and Morocco.

Pimento.—A trial shipment to Melbourne realised £28 per ton five years ago, since then the market has been as high as £140 c.i.f. London, and now is £80. We have also tried to interest both Indian and European farmers in pimento, but without result.

Turmeric.—Excellent wild turmeric is produced here but is marketed in such poor condition, and so badly prepared, that only small quantities are used. We have asked Fijians and Indians to prepare it properly but they say it means so much extra work for them. Our efforts have been fruitless. Imported turmeric is worth to-day £28 per ton c.i.f. London for best quality.

We shall be pleased to give you any further information relative to above products should you desire it.

Yours faithfully,

A. Q. McGOWAN,
for A. Q. McGowan & Co.

The Director of Agriculture, Suva.

Mr. Pearson said that he would limit his remarks to the question of minor and side line crops for small Indian farmers outside the sugar and plantation areas, produced either for domestic consumption or for sale. It appeared to him that there was a certain lack of enterprise and a good deal of improvident farming going on. In the drier districts of the Colony rice should be considered as the major crop for the Indian although in some districts this was being replaced by cotton. He said that with cotton and rice growers a certain amount of under employment was inevitable unless they had something else to fall back on. Dhal was important as dhal or a pulse of some sort was necessary to the diet of a rice eating people. Two varieties were grown but production was not altogether satisfactory and the crop was subject to the ravages of insect pests. He went on to say that next in importance was maize grown both for supply to the Colonial Sugar Refining Company and very commonly in small patches for home consumption. This crop would be much more widely grown if a ready market could be found for it. He understood that experiments were in hand for the manufacture of maize flour which would certainly be in demand among certain classes of Indians. He also considered that some of the quick growing Indian barleys might succeed well in the Colony and also contribute to the reduction of imported flour and sharps. Other minor crops not to be lost sight of were tobacco, potatoes, ground-nuts, Mauritius beans, and in some areas eating pines. Bananas must be looked on at present as a minor crop from the Indian point of view. Then again there were condiment crops such as coriander, turmeric and mustard and it seemed not impossible that one or two of these condiment crops might be developed into quite an important commercial product, even for export purposes. Mustard oil was another necessity of Indian diet and here again the imported article which was inferior in quality could be replaced. Mr. Pearson went on to say that market gardening was another avenue of activity for the Indians of the Colony. The Indians in Fiji seem to have forgotten what is done by their fellows as market gardeners around the big cities of Northern India. It had been proved by the success of the operations of the Agricultural Department in various Provinces of India that progress was possible. He said that the antiquated idea that if you wanted to grow a crop you had only to procure the seed and put it in without regard to variety or local conditions must be abandoned. He considered that a produce market for Suva was very essential as otherwise the Indian had to hawk his produce around from door to door. An important aspect of the marketing question was the matter of communication and getting the produce to the markets.

Mr. Grant said he would like to say a few words about ghee. Even that morning he had tried to buy a bottle of ghee and was willing to pay 3s. to 4s. a bottle for it, but was unable to procure any. The ghee imported

into Suva was of very poor quality. He went on to say that mustard seed grows very well in Fiji and instanced one Indian planter who planted up one acre and sold six or seven bags of seed from that area to the Colonial Sugar Refining Company at £2 a bag. He considered that if Fiji could standardise a ghee mixture suitable to the local market there would be a considerable source of income to the producers. Potatoes were imported in large quantities and yet they could be grown very successfully in the Nadroga district. He said there was also the question of sending round men trained in agriculture to teach the Indians how to plant. He was trying to form an Indian Agricultural Association of Planters so that they would be able to co-operate with the other Associations in promoting the welfare of the Colony.

Mr. Buksh mentioned peanuts and Beni seed, because they were important so far as the Indians were concerned. Another crop of importance was tapioca. It was one of the staple foods of the Fijians and the Indians were also taking to it. With regard to rice he considered that the varieties we were using in Fiji had become deteriorated owing to the mixture of seeds and he thought this matter should be considered. In India they had two seasons for rice.

Mr. Fountain said that he had been living in an Indian district for the last eight months and they were all complaining bitterly about the failure of the rice crop and seemed very keen to grow ginger. He said that he would like some information about coffee as he considered that as a side line crop in Fiji this was an excellent proposition.

Mr. A. L. Armstrong said that the Government was very fully alive to the necessity of encouraging the production of crops by Fijians particularly of supplementary crops to those now grown. He said the first thing to do was to educate the Fijians in modern methods of agriculture and the use of implements. He informed the meeting that one Agricultural Instructor was now working in the Sigatoka district, giving practical instruction in the handling of a plough and harrow. This Instructor also assisted the various villages in the marketing of their crops. Mr. Armstrong stated that it was essential to have an assured market for any crops Fijians grew otherwise they became discouraged and it was difficult to interest him in anything further.

Mr. Surridge said there were two aspects of minor crops he would like to draw attention to. The first was seed selection and he referred to the specimens of maize exhibited in the Agricultural section of the Show, one specimen grown by Fijians and Indians and the other grown by an European, where the contrast in the quality of that grown by the European was very striking. The other question he continued was one of cultivation. Referring to market gardens worked by Chinese he said it was usual to see the soil cultivated to a depth of 4 inch to 10 inch, whereas in the garden of an European householder one would find the soil cultivated to a depth of 16 in. He remarked that the additional 6 inch or so was very valuable for supplying food to the plant.

Mr. Barnes said that the mass of information supplied by the various speakers would be very helpful in assisting and encouraging the agricultural development of the Colony. In closing the discussion he called attention to a few points. With regard to Beni seed or Sim-sim he said that this was grown in large quantities in East Africa and also in West Africa. It should do well in the dry districts of this Colony, and find a ready local market. It was a crop worth while encouraging because it would fit in a system of rotation. He said that he would have liked to have seen a

representative of the local oil mill present at the meeting as one of the officers of the Department had discussed with the Manager of the Oil Mill the question of extraction of vegetable oils. He emphasised the desirability of improved systems of cultivation. This subject was one which the Department of Agriculture and the Native and Indian Departments were very much alive to and steps were being taken to give effect to recommendations in regard to instruction in agricultural districts. In conclusion Mr. Barnes thanked those present for attending the meeting and for the interest they had taken in the subject.

LANTANA POISONING OF CATTLE IN FIJI.

By C. R. Turbet, B.V.Sc., Senior Veterinary Officer.

Since the first recorded case of the disease which we now know to be Lantana poisoning the disease, in certain locations, and under certain conditions, had become increasingly more prevalent during the past few years, until the incidence of the disease assumed such alarming proportions that considerable consternation was felt among local cattle men. For a time it was thought by them that some new mysterious infectious disease had been introduced into the Colony with imported cattle. Suva butchers were suffering severely, losing a varying percentage of nearly every lot of cattle brought into Suva for slaughter. New animals brought into local dairies were liable to contract it, as were also those newly imported and animals recently brought into the Suva district for the hospital and other dairies and those in transit through Suva.

The disease did not closely simulate any known acute infectious disease. It showed some resemblance to poisoning caused by the ingestion of certain plants characterised by photo-sensitisation and more closely resembled the text-book description of *Lupinosis*.

Occurrence.—The disease occurs in the Suva and lower Rewa disticts of Fiji and less commonly at Tailevu and Navua. It has not been recorded as occurring elsewhere but probably does so under certain conditions. The occurrence of the disease is limited to either young animals bred and reared in the beforementioned districts or animals of any age brought into them. In the former group it would appear that the calves recently weaned and beginning to sample new fodders are liable to contract the disease and slightly older animals tethered or confined within reach of Lantana and on a restricted diet of other vegetation. In the latter group a sequence of events seems to be necessary; subjection to hardship or change of habitat such as occurs when cattle are brought to Suva from some other place either within the Colony or from overseas. In the first case a journey by boat or punt or a long walk overland is necessary, in the second case a long overseas journey. It is assumed that these animals are in most instances, on arrival at Suva, suffering from partial starvation and in all cases have a lowered vitality.

In the Rewa occurring cases[1] the animals affected were heifers. One lot locally bred, nine months to a year old were depastured on the river bank, the other lot, imported heifers about 18 months old, were on an island. In each case Lantana was the chief vegetation. Other plants present were *Solanum torvum*, Guava, *Panicum barbinode*, *Mimosa pudica*, *Paspalum conjugatum*, a species of sedge, wild gooseberry, *Sida rhombifolia* and *Cassia obtusefolia*. The edible plants in each case were scantily present and non-edible plants predominated.

In the Tailevu occurring cases[2] the grazing area was suddenly restricted owing to a flood in the river. It is presumed that this caused the affected animals to sample unusual fodder plants.

Cause.—The Lantana plant in Fiji has always been considered to be *Lantana camara* and under that name the cause of the disease was cited in the first published paper[3] by the writer on this subject.

Dr. Seddon, Director of the Veterinary Research Station, Glenfield, New South Wales, stated[4] that his station had not been able to find any evidence of toxic properties in *Lantana camara.* He also mentioned that *Lantana crocea* is undoubtedly very toxic. This communication caused the writer to doubt the identification of the Lantana common in Fiji which had always been taken as fixed. On examination the characters usually ascribed to *L. crocea* were more pronounced than those ascribed to *L. camara* and therefore specimens of the plant were forwarded to Dr. Darnell Smith, Curator of the Botanical Gardens, Sydney, who named them *L. crocea.*

Description of the Plant.—Manson Bailey states[5] that " *Lantana crocea* closely resembles *L. camara* but is much shorter and more compact, the heads of the flowers are also the same size and form, but the colours are apt to sport, some producing white, others blue, the normal colour being bright red orange and yellow towards the centre of the head." This description answers that of the Fiji species. It is a compact plant but in competition becomes taller with weaker branches. Along the stems a bronze colouration is noticed in some plants. The flower colours range as follows:— white, white with yellow centre, yellow, mauve in various shades, mauve with a yellow centre, red in various shades, red with yellow centre. No blue flowers have been seen by the writer in Fiji. It is possible that both *L. camara* and *L. crocea* occur in Fiji.

The Toxic Principle.—No work has yet been done on this subject by the writer and no reference to it can be found in literature. This remains the subject of further research.

History of the Disease in Fiji.—Although the knowledge of the cause of the disease was only definitely ascertained during 1928, the occurrence of the disease we now know to be Lantana poisoning was first recorded[6] in Fiji in 1913. In June, 1913, Lawrence P. Edward, Government Veterinary Officer, reported on the death of a cow at the hospital as follows:—

" This cow was first noticed to be sick about a month previous. It was at once isolated and treated. When visited on June 23rd, she was obviously dying and so I destroyed her. When first noticed she had extensive ulceration of the muzzle and buccal mucous membrane and eyelids, with discharge from the eyes, nose and mouth. She was eating well and the temperature was 103°F. The cause is the necrosis bacillus. The symptoms gradually increased in severity with the addition of necrosis of the skin behind the ears and over the body. *Septicæmia* resulted and caused death. This condition is not very rare in Fiji. It is usually seen in recently imported animals and is very contagious and very fatal. The number of recoveries do not amount to more than three or four per cent."

Edward again reported[6] on the death of a second cow during the same month as follows:—

" The cause of death was septicæmia resulting from extensive necrotic lesions on the mouth, on the muzzle, eyelids and skin caused by the necrosis bacillus. This was a similar case to the one reported earlier in the month. The rest of the cattle are perfectly healthy."

Again in December of the same year Edward reported[6] on the death of a bull at the hospital dairy as follows:—

"I was called in to attend the bull on the 16th December. I found him to be very weak, staggering in his gait, temperature 104°F., constipated, loss of appetite and very emaciated. The integument over the muzzle was dry white and inclined to crack, there was profuse discharge from the eyes (which were very much drawn in) nose and mouth.

"The most noticeable symptom was the skin; this had lost its flexibility and had become hardened. (I can only liken it to "raw hide"). The hair in parts had fallen off. In those parts where there was much movement of the skin it had become folded and from the bottom of the folds a yellow serum was exuding. The bull died on the 19th and a post mortem was made.

"There was a gelatinous exudate under the skin. The liver was enlarged and fatty. The gall bladder was very much engorged and inflamed. It was rather larger than a human head. There was acute inflammation of the abomasum, large and small intestine.

"This is the third case of this kind that has occurred at the dairy. I am now of the opinion that it is caused by some poisonous weed."

Following Edward's report the Chief Medical Officer reported[6] to the Government as follows:—

"It is with great regret that I have to report the death of the newly purchased bull at the hospital dairy. It was quite well on arrival and the Veterinary Surgeon reported well of it . . . . . earlier in the year we lost two newly imported cows from apparently the same cause . . . . . the Manager of the Brighton Dairy Company states that he has at times lost cows, especially newly imported ones from a similar cause."

There appears to have been no further record made of the occurrence of the disease from 1913 until the writer's arrival in Fiji in 1923. In that year the writer's attention was first drawn to it in the course of conversation with cattlemen. Later in that year the first cases were observed among some cattle at Waimanu. These cattle had just a week or two previously arrived in those paddocks. Since then the disease has been often observed by the writer and Veterinary Officers of the Department of Agriculture, the outbreaks occurring chiefly in the vicinity of Suva and on the lower Rewa. In 1924 in an endeavour to ascertain the cause of the disease bacteriological tests with material from an animal dead of the disease were made in co-operation with Mr. J. G. C. Campbell, B.Sc., Government Bacteriologist. The results of these tests[7] were negative. Between that time and the end of 1927 feeding experiments were conducted with various plants including Lantana with negative results.[7]

On the 30th December, 1927, feeding experiments were commenced with *Lantana crocea* which ultimately led to the conviction of that plant as the cause of the disease.[3]

Since then, owing to the knowledge of the cause of the disease, cases have become fewer and the tendency to panic on the part of some stock owners has passed.

Symptoms.—In from two days to a fortnight after the animal has had access to lantana, the first symptoms are noticed. At first the animal manifests restlessness and loss of appetite. Soon constipation sets in and grinding of the teeth is heard. If the temperature is taken about this time it is found to be elevated to about 103°F. The skin of localized areas becomes very sensitive and later intensely inflamed. This is accompanied by an intense irritation which causes the animal to shake its head and rub its parts particularly the head and ears against fence posts and trees. A

mucoid discharge from the nostrils and a lacrymal discharge from the eyes sets in early. There is also dripping of saliva from the mouth.

The parts chiefly affected are the skin of the muzzle and eyelids, the ears and the perineum, udder or scrotum. If the animal has unpigmented areas on the body, the disease will show a preference for these locations and the skin lesions are always more intense on animals with unpigmented areas. These animals, however, are by no means the only animals to be affected with the disease which has been noticed on animals wholly pigmented. In such animals the skin lesions are not so acute but the disease may be just as fatal, the sites invariably affected being the muzzle, the ears and in some cases the coronets and base of the horns.

The inflamed muzzle becomes covered with a brownish yellow serous exudate from the surface. A similar condition is noticed on various parts of the body and the hair becomes matted with dried serum. Two days after the exudation of serum the inflamed areas become devitilized, hard and yellowish-brown. The muzzle is covered by a dry smooth yellowish-brown scab which becomes necrotic and grey in areas where the nasal discharge flows over it. The eyes are sunken and a few days after the onset of the disease the conjuctival mucous membrane is distinctly icteric. The same condition is noticed in other mucous membranes. The discharge from the nostrils and eyes becomes muco-purulent. Abdominal pain is manifested generally by groaning, grinding of teeth and assuming unnatural attitudes. Skin irritation is shown by the animal endeavouring to gain relief by rubbing against solid bodies and one animal was noticed to screw its body in a peculiar manner as though shrinking from pain. Tenderness is particularly manifested on pressure on the right side over the area of the liver and gall bladder.

Urine, golden-brown in colour, is emitted frequently in small quantities. It is rich in bile as is shown by Gmelin's Test.

Constipation persists in most cases. In some, however, diarrhœa sets in later. Appetite is capricious if not altogether lost during the course of the disease. Water is refused. The animal becomes rapidily emaciated and altogether presents a sorry appearance. In a few cases ulcer like erosions occur toward the distal extremity of the tongue and on the dental pad. The breath is fetid and the general odour of the animal is objectionable. Respiration is slow and the pulse feeble.

Death occurs in about 70 per cent. of cases in from twelve to twenty days in uncomplicated cases. Animals surviving that period usually recover.

Autopsy.—On post mortem examination there is no discharge from the natural orifices. The body is usually in an emaciated state. The skin lesions are as described under symptoms. In many cases erosions and shallow ulcers are found on the tongue, dental pad and buccal mucous membranes. Oedema and icterus of the subcutaneous tissues is common. An icteric gelatinous exudate is found in the conjunctival sac and in the brisket. An orange yellow serous exudate is generally but not constantly found in the peritoneal cavity. The content of the rumen is small in quantity but normal in appearance. The omasumal contents are unusually dry whilst the remainder of the intestinal tract is practically empty. Small areas of congestion are found in the abomasum and duodenum but they are neither constant nor severe. The icteric condition is general but very prominent along the course of lymphatics and about the hilus of the kidney, joint capsules and inter-muscular septa. The flesh is fevered. The most prominent and constant post mortem finding is always associated with the liver and gall bladder. The liver is always enlarged and friable, varying

in colour from yellowish red to ochre-yellow in different animals. Some livers are slightly mottled. The typical gall bladder found in the disease is tremendously distended, containing up to two litres of bile. The wall being stretched to utmost thinness and in some cases bile is found to be weeping through the wall. Organs in contact with the gall bladder are often found stained with bile. The bile is thick and viscid, no definite blockage of the bile duct has ever been discovered in association with the disease.

The bladder is usually found distended with bile stained urine. All other organs of the body remain normal in appearance.

Pathology.—It would appear from the nature of the lesions that a toxicological principle is contained in the ingested plant *Lantana croeca*, which acts specifically on the autonomic nervous system in such a manner as to paralyse the heat regulating mechanism of the skin and the peripheral blood vessels particularly in those regions supplied by the fibres of the dorsal cutaneous nerves from the cervical sympathetic, the most constant and early skin lesions being found about the head and ears. The internal lesions are all associated with loss of tone in the plain muscle walls of the affected organs, the gall bladder loses its contractile power. The omasum has no longer power to perform its mill-like function and the contents become dry through absorbtion of fluid from the stationary mass of its contents. The bladder is distended and urine trickles away frequently in small amounts as opposed to the normal large evacuations at greater intervals. Continuous constipation and absence of movement indicate paralysis of the muscle wall of the intestines. All these various functions are controlled by the autonomic nervous system and lesions manifest are such as would be produced by paralysis of that system.

Treatment.—As is indicated by the high rate of mortality, treatment is often unsuccessful. The percentage of recoveries is greater, however, among treated animals than untreated ones. The aim in treatment has been in the first instance to remove as much of the toxic ingesta from the alimentary tract as possible. To this end a purgative drench as follows is usually given:—magnesium sulphate 1 pound, powdered ginger one ounce, tinct of nux vomica one ounce, for an adult. Since the animal refuses to drink voluntarily regular drenching with water must be undertaken. Animals which have recovered have been so treated. Chloral Hydrate in half ounce doses well diluted with water might be given to relieve pain but tincture of opium or morphine is contraindicated for this purpose owing to the paralysing effect of that drug on the bowel wall, an opposite effect being desirable. To increase the tone of the latter organ strychnine in one grain doses or tincture of nux vomica in one ounce doses might be given. Dilute hydrochloric acid in doses of two drachms has been given well diluted with water to prevent the absorbtion of toxins. Enemas should be given.

The skin lesions have been treated with a lotion composed of potassium permanganate zinc sulphate and lead acetate, of each two drachms in two pints of water, or an ointment composed of zinc oxide and bismuth subnitrate of each two drachms, lanoline two ounces and lamp black sufficient to make the ointment black.

Economic Importance.—The number of cattle actually lost through this disease has not been great and since the cause of the disease is happily now known losses can be avoided. Formerly, however, the position was alarming, local butchers did not feel confident in bringing cattle to the Suva district for slaughter owing to the prospects of the deaths of several. Movements of cattle were retarded and breeders were loath to import cattle or to purchase

where it would be necessary to move their cattle through the Suva district enroute to their destination.

Occurrence in Other Countries.—Naturally, occurring cases of the disease are recorded in Queensland but the causal plant is recorded as *Lantana camara* and *Lantana sellowiana*.[8] [9] The disease has been produced experimentally at the Veterinary Research Station, Glenfield, New South Wales.[10]

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Owing to delay in receipt of blocks, photographs prepared by the author will be published in a subsequent issue.

NOXIOUS WEEDS AND THEIR CONTROL IN FIJI.

By. H. W. Simmonds, F.E.S., Government Entomologist.

J.M.R

PART II—BIOLOGICAL CONTROL.

The control of weeds, always a serious problem in agriculture, becomes particularly so when those weeds invade grazing lands, or such permanent cultivation as coconuts or rubber, where the return per acre leaves little margin for hand eradication or the use of chemical methods. In such situations weeds of a perennial type are apt to take possession as opposed to the annual types which more frequently occupy ploughed lands. These weeds are usually of foreign origin and are often of quite minor importance in their homes, their success in their new environment being due to their finding some special facility for seed distribution *i.e.* some agency such as doves or mynah birds which feed upon their fruits and scatter their seeds, or an absence of enemies which reduce their seeding power. It will also generally be found that they are distasteful to cattle and thus these animals, by selecting the more desirable growths and avoiding the weeds, favour the spread of the latter.

In such cases it has been felt that the introduction of those agencies which, in its own home land, hold the weed in check, would be the most efficient and economic method of bringing about their control. Such a method has much to commend it, since control, if attained, would be permanent. Still, until recently, it could not be said that very great success had attended the efforts made, from time to time, in this direction. However, the results recently obtained in the control of prickly pear in Australia, by means of a pyralid moth, *Cactoblastis cactorum* aided by two other insects *Dactylopius tomentosus* and *Chelinidia tabulata*, have been most spectacular and give encouragement for further efforts of the same nature.

It must not, however, be thought that such results can in every case be attained. It will often be found that the weed is closely allied to some cultivated crop, when the risk that any agency which attacked the weed would also attack the cultivated crop, would be too great to be taken.

Seed Destroying Agencies.—In many cases the most efficient controls

will prove to be seed destroying agencies and these do not kill the host plant, which still has to be eradicated by hand. They do, however, reduce its powers of seed production so that, when a piece of land is cleared, it is not immediately resown from adjoining waste areas. Such seed destroying agencies are frequently specific and thus likely to be the safest, as well as the most efficient.

Noxious Weeds in Fiji.—The principal noxious weeds of permanent cultivation in Fiji are:—

Lantana crocea.	*Psidium guayava.*
Clidemia hirta.	*Solanum torvum.*
Stachytarpheta indica.	*Micania scandens.*

Lantana.—This plant, a native of Central America and now a major noxious weed in many parts of the tropical world, was probably the first plant the control of which was attempted by biological means. In 1902, Koebele visited Mexico and collected a large number of insects which he forwarded to Hawaii for the control of the weed in those islands. Of these introductions, eight were successfully established and undoubtedly by their combined efforts, lantana is very largely checked in its growth and power of spreading. Thanks to the courtesy of the officers of the Hawaiian Sugar Planters' Association certain of these insects have been obtained from Hawaii and introduced into Fiji. The first of these introductions was made about 1912 when Jepson successfully introduced the seed-eating fly *Agromyza lantanae,* Frogg.

Further control seeming desirable, a consignment of the flower eating butterflies *Thecla echion* and *Thecla agra* was obtained in 1921. The former was liberated on Taveuni and the latter at Suva. Only the latter established itself, being now abundant on Vitilevu and Ovalau.

In 1927 the writer visited Honolulu and returned with a large consignment of a leaf sucking Tingid bug, *Teleonemia lantanæ,* Dist. This was probably the most successful of the introductions in this country for, although for a time in doubt owing to the attacks of another bug, *Germalus pacificus,* it has since spread rapidly, passing through the affected areas like fire. It does not, however, kill the plant, except under special circumstances, but for the time being, prevents any attempt at flower and seed formation.

Clidemia hirta.—This plant is also a native of Central America, where it has a number of allies. As far back as 1920 inquiries were being made on behalf of this Colony as to the agencies which there held it in control. As a result of these inquiries Urich investigated the plant in Trinidad and discovered a thrips, *Liothrips urichi,* Karny. In 1927 T. H. C. Taylor, who was working on scale parasites in that country, made a preliminary investigation upon the insect and reported favourably, whilst the following year a careful study made by W. Cook, a student at the Imperial College, showed that it was not likely to attack any economic plant.

In 1929 the writer was sent to Trinidad to introduce a colony of the insect into Fiji, which was successfully accomplished. Whilst collecting this colony he discovered a number of previously unsuspected insects, which, by destroying the seeds of the plant, were in that country doing much to prevent its spread. These insects are now being studied by two students of the College, with a view to the possible use of some later, in Fiji.

Distribution of Colonies of Liothrips in Fiji.—A strong colony of about 20,000 of this thrips was landed in Fiji in March, 1930. From this liberations were immediately made at Tailevu, Nasinu and Lami. The work of breeding and liberating colonies was then continued by Mr. Taylor, who

distributed between 35 and 40 consignments up to the end of August. These were released at Tailevu, Nadarivatu, Sawani, Taveuni, Wainunu, Navua, Ovalau, Sigatoka, Rabi and Savusavu. These consignments were sent out either as colonies of adults or on growing plants in tins, with all stages present. It is still early to give any definite opinion as to what the result of these liberations will be. The insect is small and not easily seen until it reaches considerable numbers. In December, Mr. Taylor found that the Savusavu colonies were well established and spreading, whilst in February, eleven months after their first liberation, the colony at Lami had spread 200 yards, and the Nasinu colony was also established but weak. This is the wet season when normally the insect receives a set back, and judging by the spread of lantana insects it will require at least two, possibly three seasons before any judgment can be made as to its adaptability and powers of increase.

Stachytarpheta indica (Blue Rat Tail).—Like the preceding two, this also is a native of Central America, and, when in the West Indies, the writer made a preliminary investigation which gave encouragement that it might be possible to do something to check the spread of this plant biologically. It was found that a certain proportion of the seeds were destroyed; but the agency was not definitely proved. It was probably a *Cecidomyiid*, but, if so, was very heavily parasitised. The elimination of the parasites would of course greatly increase the efficiency of the control.

Limits of Biological Control.—Biological control of noxious weeds is only possible where the weed which it is proposed to attempt to control is not nearly related to any cultivated crop. For this reason the use of this method against *Solanum torvum* is out of the question.

As control will usually take the form of reduction of seeding, the plant, if a perennial, will continue to thrive and will still have to be eradicated mechanically. The benefit attained by the control will be the prevention of resowing when once the land is cleared.

Finally, it will probably be found that many of the agencies which help to check the spread of a weed in its own country are too general in their feeding habits to risk introducing into a new country. Nevertheless, sufficient success has now been achieved to justify, in the writer's opinion, further efforts in this direction within the limits mentioned above.

NOTES OF CONFERENCES ATTENDED IN 1930.

By H. W. Simmonds, F.E.S., Government Entomologist.

I have to report that I visited Great Britain in 1930 in order to attend the Entomological Conference held in London in June of that year as representative of Fiji. I also represented the Colony at the Imperial Fruitgrowers, International Horticultural and International Botanical Conferences held during the same season. Whilst in Great Britain visits were paid to East Malling (2), Rothamsted (2), Cambridge, Long Ashton and Aberystwyth Experimental Stations and Farnham Royal Entomological Laboratory. At East Malling attention was given to the work done on the interrelation between stocks and scions. It had been found that the ordinary commercial stocks were seedlings, genetically impure and, consequently, variable. By the use of stocks obtained vegetatively, uniformity of results was obtainable.

2. It was then observed that different strains, thus propagated, were capable of so far affecting the scion as to vary the date of first fruit production from three to twelve or even fourteen years. The stock also showed effects upon the colouration of the fruit.

3. At Long Ashton further work on the same subject seemed to show that this effect of the stock upon the scion was dependent upon the presence of a portion of the main stem and that, if the graft was made direct upon the root the scion took control and the root then assumed the characters typical of the root system proper to the scion, irrespective of any inherent variation in the types of stock used.

4. At the time of my visiting Rothamsted a demonstration in the use of Adco in the manufacture of artificial stable manure was in progress. It was interesting that the product, which in this case was manufactured from oat and wheat straw, possessed the characteristic smell of the natural article. At this Station virus disease of tomatoes and black spot of cotton were under investigation, the former also being investigated at Cambridge. In the control of these and similar diseases the production of resistant varieties seems the most promising line of research, although where possible this should, of course, be accompanied by the destruction of the insect vectors. It was stated at the Botanical Conference in reference to this subject that " disease resistance was not to be considered as exceptional or infrequent " and a number of instances were given of the methods by which the plant brought about this resistance. It was shown that vascular *Fusarium* wilt of tobacco was, in resistant varieties, controlled by a " corking out " process. Susceptible varieties, when grown under optimum temperature conditions, were often able to overcome the disease by the same methods, although at less favourable temperatures they lacked this power. In wheat and maize susceptibility or resistance to certain diseases was due to the chemical nature of the contained sugars.

5. *Aberystwyth Experimental Station.*—The work at this Station dealt with grasses, oats and clovers and was particularly interesting as showing the improvements which could be effected in these crops by the isolation of pure strains. From typical New Zealand and Danish cocksfoot grasses a large number of very different types had been isolated, many of which would give yields of food or hay, per acre, far in excess of the ordinary commercial seeds. In clovers also similar striking results had been obtained, the variation taking the forms of percentage of leaf, spreading or erect habit, weight per acre, &c. From the same original parents of red clover, types two feet in height were produced and flat dwarfs, not half an inch across.

6. Three visits were paid to Farnham Royal, the recently established entomological centre for the collection, breeding and forwarding of insect parasites from Europe to such other portions of the world as may require them. Arrangements were made with this Institution for the collection and forwarding of a consignment of the fly *Mesembrina meridiana*, the larvæ of which, living in cow droppings, feed upon housefly and other maggots.

THE CONFERENCES.

7. *The Entomological Conference.*—This Conference occupied from June 17th until the 27th. Many subjects, such as Tsetse fly and locusts, of little interest to this country, came up for discussion and in reporting this and the other Conferences it is only proposed to touch upon those subjects likely to have a local interest.

On the opening day Legislation came under discussion and the necessity for its simplification and standardisation stressed. There was a general feeling in favour of closer co-operation and linking up of Entomological Divisions, especially amongst the African delegates, in order to prevent overlapping and lead to continuity of work. Such problems as the Rhino-

ceros beetle in Samoa also are a constant menace to the surrounding groups and any method of co-operation which would assist the affected country in overcoming the pest would not only benefit the affected country in question but would minimise the danger to all neighbouring Groups. In discussing the best methods of dealing with pests where native cultivators were the rule, the opinion was expressed that much better results were obtained through the Chiefs where tribal authority was still maintained, than where this had broken down and the cultivator himself had to be treated with direct. Sometimes the production of a resistant stock, such as the nematode resistant coffee in the Congo, or the Jassid resistant cottons were very helpful.

9. A discussion on cultural methods in dealing with insect enemies was opened by Mr. Stockdale. It was shown that some pests could be checked by such means, thus mosquito blight of tea could be overcome by increasing the amount of potash in the sap, on the other hand reduction of shade in cacao often led to an increase of thirps. In the West Indies it was stated that Banana Borer (*Cosmopolites sordidus*) was almost negligible where clean cultivation was practised, on the other hand clean cultivation of sugar in Antiqua gave much greater attacks by *Diatræa*. Of interest to Fiji was the statement that sheep maggot fly attacks were often a sign of stomach worms.

10. In discussing the biological control of insect pests, methods of breeding parasites *en masse* were demonstrated with lantern slides and details given of work in progress in different parts of the Empire. Of great interest to this country was the subject of the biological control of noxious weeds, the practical utility of such methods having been much doubted until recently. The wonderfully spectacular destruction of Prickly Pear in Australia was, however, very convincing as to the value of insect control where the weed is not closely allied to any cultivated crop. Of interest also to Fiji is the fact that they are also experimenting in that country with a Trypetid fly *Exanstia aequales* for the control of Noogoora burr.

11. *Imperial Fruit Growers International Horticultural and International Botanical Conferences.*—These Conferences followed each other consecutively and, as they overlapped to some extent in the matters dealt with, they will, in this report, be treated as one.

12. From the point of view of this country the most important subject discussed was the citrus industry. The increase in the consumption of this group of fruits in Great Britain was enormous, having risen 50 per cent. between 1914 and 1924, with a further increase to double by 1929. The increase in the consumption of grape fruit was said to be amazing. In addition to Great Britain there were considerable markets for these fruits in Canada and New Zealand. It was felt that whilst there was undoubtedly much planting up taking place in South Aftica, still there was room for considerable expansion within the Empire, especially for grape fruit. It is proposed to summarise and circulate the facts on the subject.

13. Of special interest to Fiji was the fact that for the past three or four years tropical oranges and bananas were being shipped in increasing quantities from Brazil to the United Kingdom. It was stated that there was difficulty in interesting the trade in new fruits, but that a shipment of mangoes from India fetched good prices in London last year.

14. Details were given of the work of the New Zealand Fruit Control Board, which handles the export fruit of that country. This Board had statutory powers and had proved so successful that since it commenced operations in 1925 exports had increased sixfold (?). The Board consists

of four members elected by the growers and two appointed by the Government. They do not attempt to dictate prices, but distribute the fruit as they are guided by results. They also grade it and regulate the shipments, arranging transport and consigning to their local representatives, who distribute to brokers. They are financed by a levy not exceeding three pence per case.

15. I was informed that, in the West Indies, the cost of grape fruit landed on the London market works out at about 14s. to 15s. per case, whilst it fetched from 18s. to 40s. per case, top prices being obtained for late shipments. From that point of view Fijian fruit would come in when prices were high in the Northern Hemisphere. Citrus seeds have been most successfully shipped in an acid sugar culture media, having been first externally sterilised. They are apagamic, containing two to six embryos and, it is inferred that only one shoot will be cross fertilised and that the others will be vegetative and thus of the same genetic composition as the female parent. This means that in raising citrus from seed 50 per cent to 75 per cent. will breed true to the fruit that the seed was taken from, which will account for the continued production of certain types of orange in Tahiti, &c. It was also stated that as far as productivity was concerned plants raised on their own roots had been found to be as good as those on the various grafts. The necessity for obtaining genetically pure strains, both for stocks and scions was stressed by Cheeseman. In certain groups, however, such as monocotyledons, he was of opinion that advance would be best obtained by selecting good types, as the isolation of pure lines would take a long time.

16. It was stated that the variability of cacao seedlings was immense. As showing these differences Freeman quoted the case of eight trees in Trinidad which only averaged three pounds of dry cocoa per annum. These were cut out and replaced by a high yielding strain, when, after an interval of four years, a yield of thirty pounds was obtained. It was added that most estates had twenty to thirty per cent. of non-paying trees.

17. Much interesting information on bud grafting of rubber in Java, was given. The best clones gave five to six times the yield of average seedlings, but they did not in all cases pass this quality on when grafted. Certain clones had, however, been obtained which did so when it had been found that they not only gave a higher yield (2 to 3 times) but also produced a greater area of latex yielding bark, even giving good results at six feet from the ground. As a result of this work the yields in certain areas had been increased threefold and even better results might be anticipated in the future.

18. In another Javanese product, cinchona, it had been found better to use seedlings of high yielding types as a first planting on new land, but when making a second planting grafts on hybrid stocks were more satisfactory.

19. Both at the Conferences and when visiting the Experimental Stations every effort was made to obtain information regarding the interrelation between stocks and scions as it was felt that this might prove of value in citrus work in Fiji. At the Conference figures were produced, showing that in rubber the stock controlled the rate of growth of the scion, but at the same time there was a marked effect of the scion upon the root growth of the stock. The East Malling and Long Ashton experiments of a similar nature have been already mentioned.

20. Many different stocks are in different parts of the world used for citrus, the favourites being sour orange, lemon and shaddock. In some

places, such as Tahiti, oranges are grown on their own roots, as also are mandarins, whilst limes are almost always so grown. It was stated that in the United States of America sour orange gave variable results, probably being less pure genetically than the sour orange used in the West Indies. Dr. Yasami of Japan informed me that in that country two stocks were in common use, one being apparently of the sour orange type and the other being *Citrus trifoliata*. In reply to my inquiry as to the effects of these different stocks, he stated that the former produced a strong growing, disease resting plant, but that the fruit was not so fine in texture as that from the *C. trifoliata* grafts and that it took longer to come into bearing, but was longer lived.

21. Considerable time was given to cold storage problems. With bananas, reduction of oxygen without increase in the C.O. 2 in the atmosphere in the holds was advantageous and there were indications that this line of research might open up new methods of transporting fruit. It was further observed that high potash and phosphoric acid content of soil and fruit were associated with good keeping qualities.

22. Another point of interest was an attempt made to determine the connection between the quantity of mould spores present in a field and the wastage of the fruit of that field in storage. Exposed plates gave a range of from 3 to 700 mould colonies on a given surface and these counts were found to bear a definite relationship to the storage wastage, thus indicating the importance of effectively disposing of all waste fruit in the field.

GENERAL.

23. *Horticulture.*— Of more general interest were some notes on propagation given by Stewart of Edinburgh. He stated that cuttings started best in an acid soil, such as is produced by a mixture of quartz sand and pumice and that if the litmus test became alkaline a solution of 2 c.c. of glacial acetic acid to 1,000 c.c. of water was used to correct this. He advised against the removal of the leaves which he said should seldom drop off, but added that in spiny plants it was best to remove the spines. Pith was a deterrent to root formation. Oxygen was necessary in the soil water, the addition of hydrogen peroxide to the water when watering sometimes gave great increase to root formation.

24. The presence of much nitrogen in a seed bed was harmful, leading to leaf rather than root formation.

25. It was also stated that, when grafting, the use of wood from older trees for scions generally resulted in earlier flowering.

26. In conclusion I wish to express my appreciation of the opportunity thus afforded of meeting, not only other Entomologists, many of whom I have corresponded with for years, but also a number of Agricultural and Horticultural workers from all parts of the world whose work is very closely associated with Entomology.

EXTRACTS FROM QUARTERLY BULLETIN OF THE IMPERIAL BUREAU OF ANIMAL GENETICS.

THE Department of Agriculture maintains correspondence with the Bureau of Animal Genetics through the official correspondent (Senior Veterinary Officer). The Bureau is made use of to obtain the latest information on the breeding of animals, and wherever possible information derived in this Colony which might be considered of use is forwarded to the Bureau. The information is supplied by the Bureau in the form of a Quarterly *Bulletin* and the following extracts are made from issues to date:—

[*Extract from Quarterly Bulletin, No. 3, July*, 1930.]

"We would again call attention to the work at the Animal Breeding Research Department which indicates that the genetic factor distinguishing the high milk-yielding cow from her average sisters is probably sex-linked—carried in the X-chromosomes and transmitted, consequently, from dam to daughter and from dam to son to granddaughter, but never through one male to another. After two lengthy statistical studies of the records of over 5,000 cows, Mr. A. D. Buchanan Smith and Miss O. J. Robinson are now able to say definitely that the existence of this factor in the Aryshire breed can be considered as established. There is also confirmatory evidence from other breeds."

Sterility.—The other main cattle-raising problem which comes within the province of this Bureau and which especially afflicts the owners of improved breeds, is undoubtedly the problem of sterility. That this character has sometimes a genetic basis—particularly when the result of prolonged inbreeding* is beyond doubt; but it seems more frequently to be the result of obscure physiological processes, and therefore lies evenly upon the line which divides our work from that of the Bureau of Animal Nutrition (excluding, of course, sterility that is demonstrably due to pathological conditions). The physiology and bio-chemistry of reproduction in mammals are now being intensively studied at the Animal Breeding Research Department; and it is hoped that before very long sufficient of the rationale of the whole process may become clear enough for us to put definitive data before our correspondents. Meanwhile, they may be interested in a recent brief study of Mr. A. D. Buchanan Smith.

It was first noted that the feeding of sprouted oats to poultry in order to promote rapid growth in the young stock also induced fecundity and high egg production. Next, in America, it was argued that modern methods of husbandry deprived cattle of the flush of young grass during the breeding season, and that this might be a cause of sterility. It was decided to try the feeding of sprouted oats to eleven animals which were sterile but showed no abnormality in the genital organs. After treatment all of them proved to be in calf. In addition, seven heifers were fed sprouted oats before being bred; four conceived at the first service, the others required two, three and four services respectively. The treatment was also effective with six cows and ten heifers. It has not been decided what is the optimum stage of growth at which the oats may be fed. Oats which have barely sprouted and those which have sprouted 2½ to 3 inches have proved effective.

The equivalent of 5 lb of dry oats, *i.e.*, 13–15 lb of sprouted oats, is fed, and conception occurs after a feeding period averaging approximately sixty days. At Beltsville oats have taken the place of an equivalent of silage in the ration.

It is doubtful whether the treatment has any effect upon heifers with cystic ovaries or other abnormalities.

A pedigreed Ayrshire bull, which seemed to be sterile, was sent to the Animal Breeding Research Department and given the sprouted oats treatment. At the end of five months he was proved to be fertile; and there are indications that the treatment has been successful with male goats and one boar (Essex). It is not possible, however, definitely to attribute the fertility of the bull to sprouted oats, since his might be only a case of delayed maturity.

* A. D. Buchanan Smith, "Inbreeding in Cattle and Horses," *Eugenics Review*, October, 1926.

It is, of course, well known that vitamin starvation, certainly of vitamin E, will cause complete sterility in mammals and probably in other orders of the animal kingdom. But the foregoing suggests that there is a further vitamin, perhaps essential only to cattle, which is necessary for the proper functioning of the gonads. Obviously the matter is still in the hypothetical state; and further evidence, practical or scientific, would be of great assistance to most of our correspondents.

Turning now to the problems more peculiar to the tropical and sub-tropical Colonies, we would call the attention of correspondents to a recent publication of the Philippine Islands Bureau of Agriculture, *How to Build up and Improve a Herd or Flock**, which contains many facts and suggestions of great use to the Government Officer who must care for different types of stock, and at the same time cut his coat according to his cloth. The author touches upon that crucial problem of the sub-tropics—the acclimatization of "improved" breeds to unusual conditions; for if this were possible it would render largely unnecessary the prolonged work of hybridisation or of pure selection.

He writes:—"For many years horses, mules, and cattle have been imported into the Philippine Islands from the States, Australia and China, principally . . . . .

"As a general rule all the horses and mules that were fed imported feed common to their native land have fared as well from a physical standpoint and have given as long, if not longer, general average service than if they had been in their native countries and employed in the same kind of work as in the islands.

"If for some reason, through change of ownership, or otherwise, these animals are fed exclusively on locally grown feeds, containing no grain like palay or corn, they invariably go from bad to worse and within a comparatively short time become complete physical wrecks, though they may have been in splendid physical condition at the start.

"Native ponies, if fed on imported feed for several years, and in splendid physical condition, will, if turned out on local grass, actually starve to death and that within a comparatively short time . . . . . .

"Cattle of the highly improved breeds that have been imported for breeding purposes and have been kept up, or stabled, and fed suitable feeds, have also done well. Nearly all of those that were turned out to subsist exclusively on local pastures have quickly become pitiful looking physical wrecks and, sooner or later, died of malnutrition or some inter-current affection largely attributable to the poor physical condition. . . . . ."

It might at first appear as if we were here trespassing into the field of animal nutrition; but it is impossible to consider the genetics of a beast without regard to environment; and it does indeed seem possible that the inherent unsuitability of the improved breeds in exotic conditions may frequently be only a genetic incapacity to thrive on inadequate or unaccustomed food. It is questionable whether the development of good dairy or beef types even from indigenous breeds would be possible without a corresponding improvement in their feeding and husbandry; and it might therefore be worth the while of animal husbandmen, after some small-scale experimentation, to consider whether they could co-operate with the Agricultural Departments in growing such feed as would enable their improved stock, imported or native, to thrive.

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* Kretzer, David C., "How to Build up and Improve a Herd or Flock," *Bulletin* No. 43, Bureau of Agriculture, Manila.

SELECTING IMPROVED DAIRY SIRES.

Widespread Failure.—To the dairy breeder the selection of the herd sire is a most difficult problem. Recent research has shown that type can give very little indication of economic dairy characteristics. At any one time the number of bulls in a breed which are likely to create a real and positive advance is very limited; 10 per cent. of all the bulls in use would probably be a high estimate. Further, since the qualities of a herd sire in a dairy breed can only be gauged after the daughters of that sire have been raised to maturity, many, indeed, the majority, have gone to the butcher before any estimate can be made of their value to the breed as a whole.

At Mount Hope Farm, Williamstown, Massachusetts, Mr. E. Parmalee Prentice realises these things and believes that the only way to select a dairy bull is on the performance of the bull's daughters. Mr. Prentice has a herd of Guernsey cattle and he does not believe that selection by appearance and pedigree will lead to any improvement whatsoever. In fact, he goes so far as to say that the average dairy cattle, pedigreed or unpedigreed, of any country is no better than it was, fifty, a hundred, or a thousand years ago. He says that he could pick up as good high yielding cows in Poland as he could from amongst the Advanced Registry herds of the United States. Mr. Prentice does not make this statement rashly. He refers to many scientific experiments where, by mating merely on type and pedigree, no real or permanent improvement has been achieved. Particularly he refers to the experiment on poultry of Professor Gowell at the Maine Station, which was begun in 1897 and completed in 1907. Professor Gowell aimed at establishing a flock of hens of high average production by the apparently logical and obvious method of mating high record hens to sons of high record hens. After ten generations of breeding it was found that the average production of the flock was no better than at the beginning. Nevertheless, as Mr. Prentice says, the Gowell System of breeding is continued in many places throughout the country and, as regards cattle breeding especially, it is the method followed by the large majority of breeders.

Success of the Progeny Test.—Great beginnings have frequently led to great disappointments, and Mr. Prentice quotes a prominent poultry breeder as saying, "There is no man living to-day who has a two hundred-egg strain, and there never in the world has been developed a flock of birds that in quantities would average anywhere nearly two hundred eggs year after year." By his methods Mr. Prentice has proved the falsity of the statement. By selecting cockerels from high-producing strains and only using them in the flock after their value was known by means of the progeny test, Mr. Prentice has been able to develop a two hundred-egg strain in a flock of some 700 birds—a truly remarkable achievement. But he has been able to increase on this, and maintains a steady yearly improvement of about seven eggs more per bird per year. Now his average stands at about 213 eggs per bird in a 700 bird flock.

Mr. Prentice is applying the same principles to his Guernsey herd. Unfortunately, the bulls with the best genetical constitution do not always have the best daughters, for it may happen that these bulls were mated to cows of less than average production and that their offspring were so little above the average of the breed that they attracted no great attention, while high records might be made by daughters of ordinary bulls which had been mated to females of high inheritance. These good bulls might be unnoticed, while bulls of less breeding worth are not amongst the well known sires of the breed. To avoid this difficulty, with the assistance of Dr. Goodale an index of the sires breeding ability has been evolved and is employed as the basis of breeding operations at Mount Hope.

An Index of Production.—The "Mount Hope Index" is as follows:—"Compute the average mature equivalent of the milk production of all daughters of the bull; also the average mature equivalent of the milk production of the dams of these daughters, and take the difference between these averages. If the daughters' averages exceed the dams' average, add three-sevenths (or ·4286) of the difference to the daughters' average to get the bull's milk index figure. If the daughters' average is less than the dams' average, substract seven-thirds (or 2·333) of the difference from the daughters' average to get the bull's milk index figure."

"The index for percentage of butter fat is obtained in a similar manner, but with different fractions. If the daughters' butter fat average percentage exceeds the dams' butter fat average percentage add three-halves (or 1·5) of the difference to the daughters' average to get the bull's butter fat index. If the daughter's average is less that the dams' average subtract two-thirds (or ·6667) of the difference from the daughters' average to get the bull's index. Multiply the milk index by the index figure for percent of butter fat."

Concerning this index Mr. Prentice states:—"The method of appraising the breeding value of a bull by these index figures has the great advantage that it separates the two factors of milk quantity and butter fat percentage and gives the breeder a definite idea of the bull's influence on each of these important matters. Of course, like mortality tables and all other indices based on averages, the figures which come out to decimal points can rarely be numerically exact in any particular case. Being based, however, on the actual performance of the individual bull under consideration, the figures will approximate the truth, becoming more accurate as the number of dam-daughter pairs on which averages are based increases.

"The operation of the rule is such that as we pass to low levels of production, differences between dams' and daughters' averages becomes less and less, finally reaching zero at the point of minimum production for the breed. Here the sire's breeding index equals dams' and daughters' average production. But there are other differences, non-genetic in nature arising from variations in the health of the animals or from environmental conditions, particularly differences in feed and care, which, magnified by the arithmetical processes used in calculating the index, become obstacles both to genetic research and progress in practical breeding.

"Of course it is impossible, by this or any other existing rule, to foretell the future value of individual untested animals. The rule does, however, enable us to employ a correct method in selecting animals for the test, and gives an intelligible reading of the results of the test when made."

The Index for Females.—"The rule is applicable to females as well as to males, and therefore, in selecting animals for the test, choice would naturally be made of those which come from parents both of which have high indices. A bull, one only of whose parents has a high index, is, so far as concerns production, a sort of half-breed, and nevertheless not at all to be disregarded where so many pure-breds are less than this. Some young bulls can be found, however, which are not half-breeds, but which come from parents both of which have high index figures. It is upon these bulls that the hope of the breed depends. Other bulls may well be tested, and many of half-breed origin will rank high, but the best chances come with the bulls from highest ranking parents.

"A young bull chosen for the test by this method, if given light service during his second year, may before he is six years old have three or four tested daughters and a number more on test, so that while he is yet young

it is possible to reach a good estimate of his worth as a breeder. A rule which accomplishes such a result as this, is of the utmost value to the entire dairy industry, for it gives to painstaking breeders a method by which they can take their work out of the realm of speculation and make it a matter of system and orderly progress. For those who follow this practice, not only is the tragedy of slaughtering a good bull impossible, as also those other tragedies of keeping animals whose names will occur to many breeders in well-known barns, to the permanent injury of famous herds, but also—what is more important—the means are at hand by which bulls which will raise the production can be recognised."

Where production can be measured the Mount Hope method is fundamentally sound, as is the basal principle. There are other methods of measuring the progeny test than that employed by Mr. Prentice, and this point is at present under investigation at the Animal Breeding Research Department. It yet remains to be seen whether or not the Mount Hope Index is the best way of measuring the progeny test. It certainly is by no means the worst. In any case, Mr. Prentice, by his vigorous advocacy of the progeny test, is doing a service to all who would improve dairy cattle. We might add that Mr. Prentice's work has attracted the attention of many foreign Governments, and we would wish him every success in it.—A.D.B.S.

Milk and Draught.—The views that it is possible to combine these qualities in the same strain of cattle receives further support in a recent letter from Fiji (Senior Veterinary Officer), Department of Agriculture, Suva, where there is a preponderance of the Australian milking shorthorn breed. "This breed, of course, is famed for its milk production, while the steers grow to such a large size in this country that they are difficult to better as draught animals. . . . . they have also been crossed with zebu cattle, and the resulting cross provides the working bullock par excellence. Cows of this cross are also fair milkers and are good mothers. . . . . "

[*Extract from Quarterly Bulletin, No. 2, March,* 1930.]

MASS HERD IMPROVEMENT.

An interesting experiment in mass herd improvement is reported from Western Australia. The Director of Agriculture (Perth) writes:—

"Probably the most outstanding factor in regard to "Mass Herd Improvement" is covered by the establishment of the Zone System for the utilisation of pure-bred "above-standard-production" bulls in grading up the ordinary herds in the zones or districts, one breed of bull only being used in each zone with the view of providing a continuity of policy in the grading up of the common cattle.

"Although this policy is not compulsory in the cases of private individuals, it is pleasing to be able to report that it is being closely followed and is growing in importance as time proceeds, in addition to which the Government had distributed 400 standard-bred dairy sires, all of which are out of officially tested dams with production above standard and distributed strictly in accordance with the Zone System.

"The allocation of the zones was decided upon after a series of conferences with the breeders, the Council of the Royal Agricultural Society, and officers of the Department of Agriculture, the scheme being initiated by the Department of Agriculture.

"The operation of the "Dairy Cattle Improvement Act" resulted in the improvement of the class of dairy sires in use, as follows:—

" In 1923 there were 177 pure-bred bulls, of which 75 were the progeny of cows that had been officially tested, with production above standard. In 1928 the number of pure-bred bulls was 714, of which 587 are the progeny of officially tested cows, with production above standard.

" Undesirable scrub bulls destroyed or desexed during the period number 1,240."

INDIAN CATTLE.

An authority on Indian cattle has challenged the statement in the last *Bulletin* that the average yearly milk-yield of the Sahiwal herd at Ferozepore " approximates to 9,000 lb or more per cow," which was a quotation from one equally well versed in the subject. It is probable that that figure only refers to exceptional cows, and that the average of the herd is not much above 5,000 lb.

Some further comments on the last *Bulletin* come from Dr. D. Clouston. He writes that the Indian breeds of cattle are much more resistant than the European to contagious abortion—" Some of our veterinarians in India attribute the prevalence of contagious abortion on the military dairy farms to the introduction of exotic blood (mainly Ayrshire and Holstein) into the herds."

He also mentions that the Indian cattle of the plains, but not the hill cattle of the Himalayas, are decidedly more resistant to rinderpest than are European cattle, and require a less massive innoculation. On piroplasmosis his comment is: " Indian cattle are remarkably tolerant to the germ of this disease. It is in their blood, but the germ does not appear to become active until and unless the host gets run down in condition after an attack of rinderpest or as a result of starvation."

A GENERAL PURPOSE HORSE.

A general-purpose horse of an unusually good type has been achieved in Canada by selection of the French-Canadian horses. These horses first appeared in Canada when Louis XIV of France sent out a few of his best specimens to the new Canadian colony. Little attention seems to have been paid to them at first, which was, perhaps, all to the good, since natural selection in that cold climate with bad winter roads did its work in eliminating all except those of very high vitality and endurance. Then in 1912 the Experimental Station at Cap Rouge started selecting these French-Canadians and breeding up a stock. They have been quite deliberately bred—mainly by inbreeding—for general purposes, and the resulting horses are reported to be useful and attractive animals. Usually black in colour, rather like a large Welsh cob, they are said to look and trot well in a trap or even carriage, and, at the same time, when put to heavy labour seem able to outwork bigger and heavier team-mates of other breeds. They are described as docile and kindly animals that put their hearts into their work, and can even endure a Canadian winter in open-fronted, single-boarded sheds without suffering. Apparently too, they are not limited to a cold climate, since a team was sent out with the Royal Canadian Artillery to South Africa for the Boer War, and returned unaffected by the climate.—Experimental Station, Cap Rouge, Quebec, Canada.

EPILOGUE.

It is the desire of the Bureau to build up a picture gallery of the live-stock of the Empire, since a good photograph is of more value than any description in indicating the type and points of a beast under consideration. Moreover, the Bureau is now engaged in preparing the material for a mono-

graph on the phylogeny of the domestic animals, and is also co-operating with the Bureaux of Animal Health and Animal Nutrition in a rapid survey of the live-stock of the Empire and their commercial potentialities. We should therefore be very grateful to any correspondents who would send us photographs of their animals, particularly of the indigenous types and first and later crosses, and so enable us to be of more assistance when consulted.

PINEAPPLE CANNING

By D. H. Grist, Agricultural Economist, British Malaya.

Factory methods for canning pineapples vary considerably between Malaya and the other countries of production, notably Hawaii. In the latter country, machinery is used as much as possible, whereas in Malaya, owing to its relative cheapness, hand labour is employed for almost all the operations. It is a curious fact that while in Hawaii the cans are purchased from a central can-making factory, in Malaya each factory is equipped with a complete can-making machinery.

A further marked difference between these two countries is that in Malaya the factories are generally established in close proximity to the pineapple plantations. The most distant are the five factories in Singapore, which draw the bulk of their supplies of fruit from Johore—a matter of perhaps 30–50 miles by road. The nearest to the centres of production are in Johore where there are twelve factories, situated so close to the fields that transport is reduced to a minimum. The principal factories in Hawaii and Africa may be situated a considerable distance from the plantations. The nearest plantation to the largest Hawaiian factory is twenty-five miles distant. The Port Elizabeth factory is 125 miles from the estate, the latter being intersected by over 150 miles of roads.

The fact that by the Malayan method, transport both of fruit and empty cans is reduced to a minimum, has its advantages. The fruit can be harvested in a riper condition than would otherwise be possible, while the factory methods are such that generous use is made of labour—which is comparatively cheap; while freight—which is comparatively expensive, is reduced to a minimum.

The question of power must also be considered in connection with situation and size of factory. In Hawaii, electricity is used at a cost of from 2–4 cents (gold) per kilowat. In Malaya, the power required for a factory of 1,000–1,500 cases per day can be supplied by an engine of 15–20 h.p.

CAPACITY OF FACTORY.

Factories in Hawaii are capable of turning out 1,500 cases per day; one factory is said to have a capacity of 4,000 cases a day. The largest output by a factory at Port Elizabeth, South Africa, is stated to be 2,300 cases per day. From a consideration of the number of factories working, the methods employed, and the total quantity of canned pineapples exported, it is evident that the average capacity of a Malayan factory is lower than that of Hawaii or Port Elizabeth. Probably from 1,000 to 1,500 cases per day is the utmost limit of our local factories, while the capacity of the majority is even less.

COST OF FACTORY.

According to an Hawaiian authority, the cost of machinery, (excluding the cost of the buildings) capable of producing 1,500 cases per day, would be the equivalent of about $90,000 (Straits Currency). An important pineapple

packer in Malaya published a statement in 1927 that "about $150,000 capital is necessary for an ordinary pineapple factory and for a factory of bigger capacity $300,000 will have to be invested." These figures, obviously, include working capital. The machinery in a Malayan factory with a capacity of 1,000 cases a day may be between $13,000 and $20,000 excluding shafting, power and cost of building.

The following details of factory methods refer to Hawaii and South Africa. The Malayan methods are so different, that they will be stated subsequently.

CAN-MAKING.

Hawaiian canners do not manufacture their own cans, but purchase them at $28 (gold) per 1,000 from a can-making factory. A similar system is employed in Formosa, where the areas under the crop are somewhat scattered.* The Port Elizabeth factory manufactures its own cans with a plant capable of producing 30,000 to 35,000 cans daily.

A machine cuts the tin-plate to the requisite size for the body of the can. Flanges are then cut at each end of the body section to make the hooks or edges which will interlock to form the two side seams. It is then rolled to a cylinderical shape, double seamed, interlocked and automatically soldered. The bottoms and tops are cut out and shaped by a press, the bottom being then fixed on a by seaming machine. Rubber solution (in Malaya, a thin band of rubber, locally manufactured) is applied in a groove on the outer edge of each disc; this renders the use of solder unnecessary and ensures that the cans are airtight.

PEELING, CORING AND SIZING.

The "Ginaca" machine automatically performs the operations of peeling, coring and sizing. It is made in three sizes; Viz., No. 2½, No. 2, No. 1. It has the disadvantage that it will only prepare fruit of one size diameter and cannot be adjusted to fruits of different sizes. The 2½ "Ginaca" will handle about 38 pines per minute. It is made by the Hawaiian Pineapple Company and costs $5,900 (Gold).

In the operation, the pines climb a chain conveyor and are placed in position. The machine then cuts off the skin in two pieces, cuts off the top and bottom, extracts the fruit still adhering to the skin, then cores the pine.

The fruit is then conveyed to a trimming table, where any irregularities are rectified by hand.

A slicer is then employed, also made by the Hawaiian Pineapple Company, costing $2,000 (Gold), which cuts the fruit into slices about half an inch thick.

CANNING.

The fruit is graded as it proceeds along a conveyor. The usual method is for certain of the workers to be responsible for picking out the best for "fancy" quality, others being responsible for standard quality—the remainder being broken pieces.

The broken pieces are conveyed to vats where they are broken up and boiled, becoming crushed or grated and packed in cans for special markets.

Cans containing slices are taken to a vacuum machine, costing $1,800 (gold), which removes most of the air, and thence to the Syrupping Machine

* The pineapple canning industry in Formosa is relatively small, but is rapidly increasing.

($1,100 gold) which fills them with sugar syrup and thence to the Exhaust Box, a steam chamber, where they remain for six minutes at a temperature of 210°F.

The Double Seamer ($2,500 gold) places the lid in position, bends the edges down and under, after which a second machine flattens them hard in this position.

The cans are then sterilised for seven minutes at a temperature of about 222°F., and placed in a Lacquer Bath ($250) which improves the appearance of the can and is said also to retain the can in an airtight condition.

Subsequently the cans of fruit are dried and stored until labels are affixed.

SYRUPING.

The syrup with which the cans are filled is prepared with cane sugar and water, pineapple juice not being employed in its preparation. O'Conner, reporting on the South African product states:—"Different syrups are used according to the variety of grade of fruit canned. As the 'Giant' or 'Cayenne' pineapple is less sweet than the 'Queen' variety, more sugar is used in preparing the syrup in which it is preserved."

The following is the percentage of sugar used:—

For Queen Pines, 1st Grade fruit 27 per cent sugar
For Queen Pines, 2nd Grade fruit 16 per cent. Sugar.
For Cayenne, 1st Grade fruit 40 per cent. sugar
For Cayenne, 2nd Grade fruit 30 per cent. sugar

Under the Canadian regulations affecting the importation of canned pineapples, the following are laid down respecting syrup:—

"Heavy Syrup" for pineapple will be considered as that syrup which cuts out not less than 23 per cent. Balling at 60°F.

"Light Syrup" for pineapples will be considered as that syrup which cuts out not less than 17 per cent. Balling at 60°F.

MALAYAN FACTORY METHODS.

The operation of peeling and cutting or slicing are always performed by hand. Grading is performed by the worker during these operations.

The following machinery is usually employed in a Malayan pineapple canning factory.

Foot Shears, for cutting the tin-plate into strips. Cost varies from $300 to $500 (Straits Currency). Two such machines are necessary in a factory having a capacity of 1,000 cases per day. Each machine can be worked by one man.

Roller Shears, for cutting the body strips for 1½ lb flat size. The machine will cut six strips at a time. One such machine required: cost about $1,000.

A locally made hand machine, costing about $25 each is employed for rolling the body pieces. From five to ten machines of this description are used in a factory.

The edges of the body pieces are then notched by hand with a pair of scissors.

Soldering.—Lap-soldering of the body pieces in cylindrical form is performed by hand. The usual contract price for this work is 11 cents per 48 cans.

Automatic Bordering Machine, prepares top and bottom edges for double seaming Two such machines, costing about $500 each, each with

a capacity of 3,000–4,000 cans per hour are used Each machine can be worked by one man

Punching Press, for cutting tops and bottoms; three or four such machines employed at a cost of about $900 each The dyes of different sizes for these presses are locally made and cost from $100–$200 each according to size.

Double Seamers.—For seaming bottoms to body. Cost $700 each. Two machines of this description are used for the bottoms, and another two for the lids. Capacity, about 1,500 per hour for each machine.

GRADES.

Malayan pineapples are packed in three grades, viz:—Special Golden, Good Average Quality (G.A.Q) and Number 3. No. 2, now less frequently prepared, finds a market in China. The popular description is cube, although slices and whole pines are prepared for special markets. Several descriptions of shapes of tin and weights of content are marketed, although the tendency recently has been to reduce the number. A case of pineapples may contain 48 cans of 1½ lb each, a case of 2 lb cans may contain 24 or 36 cans according to whether the packing is of whole pines or slices, while the packing of 2½ lb cans invariably has 24 cans to a case.

In Hawaii, the "sliced" is packed in two grades, "fancy" and "Standard" and apart from "Crushed and Grated" and one or two Special packings, only round cut sliced is made.

BY-PRODUCTS.

Only about one-third by weight of the pineapples received in the factory is utilised. In Malaya, no use is made of the waste from the factory. Greenstreet and Gunn Lay Teik* shew that for the economic disposal of the waste, the removal of the juice is essential. They describe remunerative methods of disposal of the partially dried waste, and also shew that the fermentation and distillation of the fresh juice for the production of a potable alcoholic liquor similar to brandy is a simple process. As far as the present writer is aware, no factory in Malaya has commercialised these results.

COST OF CANNING.

It is stated that canned pineapples can be produced in Hawaii at £20 per ton delivered to the consumer, the factory cost being about $1·50 (gold) per dozen cans.

The African costs are said to be £5 per ton for fruit, and £5 per ton for cost of manufacture.

In 1927, a Malayan pineapple packer published the following statement of the factory costs per case of 72 lb:—

16 sheets of tin plate	$1·65
Lead and soldering	0·10
Good White Sugar	0·80
One empty wooden case	0·50
Labour	0·40
Water and fire wood	0·20
Rubber stripping	0·10
General expense of the factory	0·75

a total of $4·50 per case of 72 lb to which must be added the cost of the pines (80 medium quality pines per case, costing from 1–2 cents each).

* "By-Products of the Pineapple Canning Industry" by V. R. Greenstreet and Gunn Lay Teik.—*Malayan Agricultural Journal,* Vol. XVI, No. 1, January, 1928.

The total cost per ton on this computation would be $186 or approximately £22 ton. In view of the fact that the price of canned pineapples in Singapore is below this figure, it must be supposed that packers have been able to reduce their costs of production. In any case, the above statements of costs in different countries must be taken, at best, as only a rough approximation.

In conclusion, the writer has tried to shew that the Malayan pineapple canner has endeavoured to establish a market for a cheap but good quality product. This has been made possible by the following means; employing cheap labour, treating pineapples as a catch crop, placing the factories near centres of production, and producing a less elaborate and unlacquered can. The market now established, the quality of the product has been improved, and there would appear scope for further extension of the industry.

In the preparation of the above article, the writer is indebted for considerable assistance from the following sources: Notes on the Pineapple Industry in Hawaii, from a private source; The Pineapple Industry in South Africa from a Report by Mr. C. A. O'Conner of the Mauritius Department of Agriculture; Mr. P. T. B. Hansen of Singapore; The Empire Marketing Board Reports; and data collected from time to time by various officers of the Department of Agriculture, S.S. & F.M.S.

COCONUTS.

British Malaya.—The following particulars are taken from a report of progress in relation to coconut research up to June 30, 1930, furnished by the Department of Agriculture.

Ceylon Coconuts.—The Agriculturist visited nine estates in the North-West Province of Ceylon for the purpose of investigating the various methods employed in the cultivation of coconuts and the preparation of copra. The results are embodied in a report which has been published in the *Malayan Agricultural Journal* (1930, 18, 378) and the chief points therein may be summarised as follows:—

1. There are approximately 1,000,000 acres planted with coconuts in Ceylon.

2. The annual rainfall in the areas visited ranges from a minimum of 45 in. to a maximum of 103 in. per annum (Malayan limits 40 to 230 in.).

3. The soils range from light sand to very light clay (lighter than Malayan coconut soils).

4. The estates generally vary in size from 400 acres to 1,000 acres.

5. Planting is between 60 and 70 palms per acre, but this is considered too close, particularly on estates which practise a regular system of manuring.

6. The average age of palms varies between 35 and 45 years (Malayan Estate: 20 years (av.); Native: 30 years (av.)).

7. Clean weeding is not practised and most of the estates are under light grass which is kept grazed by cattle.

8. On a number of estates grass is being replaced by low-growing, leguminous cover plants and *Dolichos Hosei* is generally employed for this purpose.

9. The general practice is to plough to a depth of 6 or 8 in. and then harrow with a disc harrow alternate rows every two years.

10. It is generally recognised that more satisfactory returns can be obtained by the application of artificial manures. The composition of the manures employed varies considerably, but as a rule 8 lb of a complete mixture is applied in alternate rows annually.

11. Harvesting takes place at two-monthly intervals and an average of two bunches per palm is collected at each picking.

12. The heaviest pickings occur during the wettest months, May and July, when the yield is over twice that of the smallest monthly yield.

13. For the nine estates visited the average yield of nuts per palm is 66 and the yield per acre averages 3,940 nuts. (The yield of nuts per palm for estates under Malayan conditions is approximately 50, with an average yield of 2,200 nuts per acre).

14. Only ripe nuts are harvested. The nuts are stored in heaps of from 3,000 to 4,000 in the field for about 4 weeks in dry weather and for 5 weeks in wet weather. Husking is done in the field and transport is by bullock cart or light railway.

15. Kiln drying is the general practice and the system is to dry in the sun for one day on a cement barbecue. The nuts are then placed on the kiln in a layer 12 in. to 18 in. deep and turned daily. After 2 days the shells are removed and drying is completed after 2 or 3 more days—making 5 to 6 days in all. (Malaya 1½ to 4 days.)

16. Special precautions are taken to prevent mould growth in the store-shed, where sorting into three grades of quality is carried out.

17. The average yield of copra for the nine estates was 14 piculs per acre (Malayan estates average 9 piculs per acre).

Arrangements have been made with six estates in Ceylon to supply selected seed nuts from five of their highest yielding palms with a view to establishing small experimental plots in Malaya. Of the first lot of seed nuts, some 300 have been sent to the Experimental Plantation, Serdang, for germination, while the remainder have been examined in the Chemical Division. The full report is not yet available, but the following figures may be quoted:—

	Two Malayan estates.	Nine Ceylon estates.
Average weight of wet meat. ..	475 grms.	405 grms.
Average oil content (dry basis) ..	65·6 per cent. (Av. of 60 croppings from different trees.)	67 per cent. (Av. of 35 nuts from from 30 trees.)

Small experimental plots will later be established with these Ceylon nuts on six selected estates in different parts of Malaya, and when the palms eventually come into bearing a chemical examination will again be made of the nuts so produced under various Malayan conditions.

Copra Research.—The following is a résumé of the work of the Assistant Chemist for Copra Research.

The Structure of the Wet Meat in the Nut.—Considerable variations exist in the oil and moisture content of different pieces of wet meat taken from a single nut, particularly if the nut is not ripe. Furthermore, any one piece of wet meat is itself far from uniform in structure.

(*a*) *Oil Gradient.*—Nuts which have not quite begun to germinate may show an oil percentage of about 35–40 per cent. (dry basis) and a moisture content between 75 and 80 per cent. on the inside face of the wet meat, whereas immediately under the testa or brown skin the oil content will be in the neighbourhood of 70 per cent. to 75 per cent. (dry basis) while the moisture may lie between 20 per cent. and 50 per cent. A more unripe

nut will show a still steeper oil gradient, but, on the other hand, as the nut ripens and begins to germinate the moisture percentage becomes less and the oil content becomes practically uniform at between 68 and 75 per cent. (dry basis) throughout all the layers of wet meat.

These facts have an important bearing on (1) the methods of sampling for purposes of analysis and comparison of individual nuts, (2) the best time for picking to give the highest oil and copra yields per nut, (3) the means to be adopted to dry the copra so as to obtain a white, uniformly well dried, brittle product.

(*b*) *Structure and Ripeness.*—A long series of comprehensive observations are being made of the physical and chemical characteristics and the structure of under-ripe and over-ripe and just-ripe nuts obtained from high, medium and low-yielding palms.

The results so obtained will provide important information as to the changes occurring in the ripening nut, and, more important still for practical purposes, will indicate definitely what problems have to be faced in drying and the methods which should be adopted to obtain the whitest and most oily copra in the quickest way possible.

It has already been found that:—

1. While the ripe nuts from certain trees regularly show a uniform oil content in the neighbourhood of 63 per cent. others give ripe nuts containing 71 per cent. of oil (dry basis).

2. The ripe nuts from one tree were found to require 189 nuts to produce a picul while another required 360 nuts.

3. When one takes into consideration the average annual yield (for nine years) the following average annual equivalent yields are obtained from the selected palms when ripe nuts are picked.

Palm.	Av. oil content of copra (dry basis). *per cent.*	Av. nut yield per annum.	Av. No. of ripe nuts per picul.	Equivalent copra yield per acre. (*piculs*).
1	67	106	260	20
2	71	107	225	23
3	71	67	360	9
4	63	67	280	12
5	65	27	290	4·5
6	68	16	270	3·0
7	69	104	250	21
8	67	87	180	24

1 picul = 133⅓ lb

(*c*) *Ripeness, Oil and Copra Yield.*—Concurrently experiments are being performed on other estates in which the problem is being approached from another point of view. The whole crop from a given area is being divided into picked and fallen nuts, all rotten nuts being rejected. These nuts are then being split and divided into five groups according to the absence or size of the embryo. The number of nuts in each group is counted, and the wet meat is then converted into copra and weighed and finally analysed for oil content and judged for appearance.

On the first estate selected, of over 1,000 nuts examined from a mature area producing 11 piculs to the acre, 486 nuts had fallen naturally, while 498 were picked; in addition 50 ripe unsprouted, picked nuts were taken from an adjoining area and were stored for one month. About 70 per cent. of the nuts were collected in a satisfactory condition of ripeness, whilst the remainder were only slightly more over-ripe or under-ripe. In the circumstances striking differences of copra yield and oil percentage were not brought out. The smallest number of nuts required to produce a picul

of copra was shown by fallen nuts with pea-sized to ¾ in. embryo, viz., 188 nuts, the largest number of nuts was required by the just not ripe fallen nuts which required 218 nuts to make a picul of copra. The 50 picked ripe nuts after being kept for one month required proportionally 227 nuts to make a picul of copra. The average yield for the whole area showed that 200 nuts were required to make a picul of copra. When one remembers that Malayan estate pickings average 250 nuts to the picul whilst native pickings take up to 350 nuts to the picul, one is able to appreciate the excellence of the nut collection in this estate.

(*d*) *Physiology of Growing Nut.*—Experiments are about to start on the weekly comprehensive examination of dated nuts so that the rate of development of wet meat, copra and oil can be studied while the nuts are ripening (*i.e.*, from 200 days old to 500 days old.)

Provisional Conclusions.—It will appear that the best time of picking in order to produce a good uniform type of copra will be when the oil percentage of the wet meat is highest and most uniform, when the moisture conditions are lowest and most uniform and, irrespective of any slight corrosion near the embryo, when the greatest weight of dry meat is obtainable from the nut. It is believed that these conditions are satisfied when a haustorium about 1 in. in diameter is to be found in the plucked nut. Thus only ripe, fully brown nuts should be picked. On the other hand, large quantities of nuts are being picked in this country in a state of extreme under-ripeness, and as a result the copra produced from the very wet meat contained therein is thin, wrinkled, low in oil, and irregularly dry and therefore prone to mould growth and deterioration. Two such nuts will only produce the same weight of such inferior copra as of good oily copra produced from one fully ripe brown nut, and will take longer to dry.

Driers.—Some consideration has been given to the product obtained from a number of different driers, but the more complete examination of the working of each individual drier will be deferred to a later date. The present indications are that drying in Malaya has been speeded up at the expense of the quality of the product as regards oil content, uniformity and amount of contained moisture, and colour. Extra heat applied at the wrong time and with insufficient air movement has resulted in a case-hardened product, with a wet centre, an apparent loss of oil, insufficient and/or irregular drying, caramelisation and in some cases actual burning.

It has been noticed that the drier meat from the more ripe nuts is more prone to yellowing and caramelisation during drying than is the wetter meat from unripe nuts. This fact will have to be borne in mind and the drying conditions will need to be designed so as to overcome this trouble.

In order to work out and develop a standard process to produce perfect copra it is necessary to start with, as far as possible, a uniform raw material. If any unripe or over-ripe nuts are removed and dried separately, the bulk of ripe, brown nuts can be dried under the conditions calculated to produce a uniform and white product of maximum dryness in the shortest time possible.

Types of Copra.—An interesting series of sorted types of copra was exhibited at the Kuala Lumpur Show. The oil content of each type of copra was calculated and an approximate idea of the thickness of the copra was determined. The results show that careful preparation and nut collection is rewarded by a higher oil and copra yield.

It can also be observed that a high oil percentage (dry basis) may indicate either that the copra has been derived from over-germinated nuts, or, on the other hand, that considerable deterioration has occurred.

Type of copra.	f.f.a.	Oil per cent. (d.b.).	Oil per cent. (w.b.).	Average thickness	Relative yield per nut estimated.	
	per cent.	per cent.	per cent.	mms.	Oil.	Copra.
Good F.M.S.	·06	65·6	61·9	9·0	100	100
Wrinkled from unripe nuts ..	·63	60·0	55·2	5·0	51	56
Thin from over-ripe nuts . ..	3·01	74·2	70·7	4·5	60	52
Burnt and carbonised	·34	64·9	60·3	8·5	94	96
Caramelised and slight insect attack	·24	64·8	61·5	8·5	96	96
Burnt and heavy insect attack ..	1·50	60·1	56·9	7·0	74	80
Slimy, black and rancid	5·01	73·7	68·8	7·5	80	72
Heavily black moulded	5·25	68·3	64·3	8·5	92	88

Good quality F.M.S. copra may show a somewhat low oil percentage (dry basis) from certain trees and areas, but a very low oil percentage is generally indicative that the nuts have been picked young or that the copra has been burnt and/or heavily attacked by insects.

Storage of Copra.—The high oil content shown by mouldy copra after prolonged storage is due to the removal of the inner layers of low oil content by the moulds, the remainder showing a slowly increasing oil percentage as a result. During shipment and handling in storage a heavily moulded copra may dry out when the mould will fall away as dust, leaving the copra clean, frequently still internally white and rich in oil. Furthermore, if inferior copra which has developed, a high degree of rancidity and mould growth is stored under good conditions, the acidity is actually able to diminish while the copra as a whole will become dry and cleaned up.

Six large samples have been stored for three months in airy conditions and the two extreme examples are as follows:—

Copra from Muar.—Light brown, mouldy and slightly attacked by insects—

	per cent.
Original acidity	·72
Final acidity	·42

Copra from Kelantan.—Dark brown, very mouldy and insect ridden—

	per cent.
Original acidity	3·12
Final acidity	·80

All the samples showed a more or less proportional reduction in acidity and finished up dry and mould free.

The explanation of this is to be found in the drying out of the copra. Further acid formation is arrested while the acidity already existing is gradually converted into water vapour and gas. It must be appreciated that during deterioration coconut oil is turned into free acid with considerable heat development and that the free acid so formed is lost with further heat development.

Financial Losses in Storage.—The full extent of the losses sustained by the producer when his copra is piled as a huge stack in an ill-ventilated storehouse, in order to dry out the copra preparatory to weighing, has yet to be determined. Very considerable heat formation and darkening, mould growth and acid formation are found, with the result that a loss in weight due to oil loss occurs and a higher percentage of copra is classified as F.M. owing to deterioration of the good pieces of F.M.S. quality down to trade

F.M. The remedy for this state of affairs really lies with the producer, because if he completely dried his copra it would not deteriorate in storage nor would it need to be stored before acceptance. Furthermore, because of the time and trouble saved to the shipper, he could offer a better price for guaranteed dry copra.

Insect Attack.—Another matter which is receiving attention in the department is insect attack during storage resulting in very considerable losses in copra weight and total oil.

A number of samples of copra have been received from world-wide sources, but owing to detention in transit, the time since despatch has been considerable, with the result that extremely heavy insect attack has resulted. The material has not yet been analysed, but from its appearance, the immense amount of fibrous dust present and the method of attack, it is obvious that the insects have consumed the oil and rejected the fibrous material. The copra is in many cases a mere shell, buried in brown dust; the rich oily copra immediately under the testa has almost in every case been completely removed and attack has taken the form of tunnelling from the soft inner surface of the meat straight towards that oily meat under the testa.

When burnt, " caramelised " and white copra are found side by side, the two former are attacked first, and for a while the white copra remains unattacked. It will be remembered that in the cropping experiment the most ripe nuts produced a caramelised yellow product which was rich in oil. The oily nature of this copra may be the reason for the preferential attack, or alternatively the more pleasant flavour of slightly burnt copra may be the cause.

Existing stores should periodically be cleaned and sprayed with disinfectant, the copra should be piled only in a dry state, and the production of " case-hardened," hastily prepared copra with a hard skin and a soft wet centre should be avoided. It would be better, however, if stores were built with windows and doors constructed of iron gauze so that when clean dry copra is put in, free ventilation is possible, but the ingress of insects is prevented.

EMPIRE FRUIT SUPPLIES, 1930.

THE following extract has been taken from the *Weekly Fruit Intelligence*, issued by the Empire Marketing Board, dated 7th January, 1931:—

The year 1930 has in many ways been a notable year for Empire fruit on the British and continental markets so far, at any rate, as the volume of supply is concerned. In the early part of the year, shipments of grapes, peaches and plums from South Africa established new records, and the total for all deciduous fruits throughout the season was little short of 2,500,000 packages, an increase of 900,000 over the preceding season and of 500,000 over the previous record in 1928–29. At the same time Canada was shipping apples from a Nova Scotian crop gathered in the autumn of 1929 exceeding all previous figures, and exports of barrel apples to Europe, for the first time for many years, exceeded the corresponding shipments from the United States, while the close of the Jaffa orange season in May showed total exports of 2,700,000 boxes, or 700,000 more than the previous record in 1926–27.

During the summer months Australia and New Zealand shipped respectively 4,320,000 and 1,100,000 boxes of apples to Europe, the bulk of them to the United Kingdom; in each case these were larger totals than had ever been recorded previously, while, at the same time, shipments of pears

from these two Dominions also reached record proportions. Throughout the summer also, the large South African orange crop was being marketed almost entirely in this country, and reached the formidable total of 1,840,000 boxes, or 740,000 more than had ever previously been shipped overseas in one season, while South African grapefruit exports, exceeding 100,000 boxes, were not much short of double the largest exports hitherto recorded. Towards the end of the year the new Canadian apple crop began to reach Europe in even larger quantities than at the beginning of the preceding season; the 1930 British Columbian crop was the heaviest in history, and although the Nova Scotian and Ontario crops were relatively light, they have moved across the Atlantic in large volume, total shipments from Canada to Europe from the 1930 crop up to the end of the year aggregating some 3,700,000 boxes (including barrels in terms of boxes), as against 2,900,000 at the same time a year ago.

Finally, shipments of bananas from Jamaica during 1930 reached new heights, exceeding the 22,000,000 bunches exported in 1928, and although the United States is the chief market for Jamaica bananas, imports into this country also established a new high record.

FIJI LIVESTOCK RECORD ASSOCIATION.

MEETING OF BOARD OF DIRECTORS, 7TH OCTOBER, 1930.

Present.—Director of Agriculture (Chairman), Messrs. G. Kiss, J. Barber and C. R. Turbet.

1. The minutes of the previous meeting were read and confirmed.

2. Mr. Kiss raised the question of opening a calf register. After discussion it was decided that Mr. Turbet should prepare rules for such a register.

3. Owing to the shortage of veterinary staff it was decided that Rule 47, which provides for the branding of stock with the Association's brand, should not be enforced in the meantime, and that stock should be registered without bearing such brand.

4. It was decided to hold the Annual General Meeting of the Association on the date of the " Tofua's " sailing in January, 1931.

5. It was decided to print the herd-book prior to the Show to be held in October, 1931. The Board was of the opinion that stock entered for competition as pure-bred should be required to be registered in the Association's herd-book.

ERRATA.

IN the list of noxious weeds to be found in Vol. 3, No. 3, p. 112, certain botanical names were spelt incorrectly. Thanks are due to Mr. W. Greenwood of the Colonial Sugar Refining Company Limited, Lautoka, first for supplying the names, and secondly for drawing attention to the inaccuracies.

Since the publication of the above *Journal*, the Burr (unnamed) on the same page has been identified by Dr. Darnall Smith as *Urena lobata*, var. *scabriuscula*.

Errata.	*Corrigenda.*
Acacia farnesiana ..	.. *Acacia farnesiana*, Willd.
Stachytarpeta indica ..	.. *Stachytarpheta indica.*
Cenchus echinatus . ..	.. *Cenchrus echinatus.*
Eleophantis scaber . ..	.. *Elephantopus scaber.*

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ORNAMENTAL TREES AND PALMS FOR SALE.

A LIMITED number of ornamental trees and palms is available for sale from the Nasinu Experimental Station. Particulars are obtainable from the Department of Agriculture.

A. C. BARNES,
Director of Agriculture.